THE

ELECTRICAL REVIEW.

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THE DEVELOPMENT OF THE GERMAN MANUFACTURER.

As we briefly recorded in our last issue, the Allgemeine Electricitäts Gesellschaft have made arrangements which will have the effect of absorbing the Felten & Guilleaume-Lahmeyer Works Co. The reason given for this latest absorption is that the Felten & Guilleaume dividends had been seriously restricted by the slackness of the dynamo factory at Frankfort, and as a result of negotiations, an understanding has been arrived at by which the dynamo works of Felten and Guilleaume are taken over by the A.E.G. in return for an issue to the former company of A.E.G. shares. The A.E.G., however, only takes over the Lahmeyer dynamo factory under the provision that it secures a controlling influence over the Felten & Guilleaume Co. This arrangement necessitates an increase in the capital of the A.E.G. to £6,500,000, which is probably greater than the aggregate capital of the large English electrical concerns.

The results of this fusion of interests are bound to be of the greatest importance to the German electrical industry, and, in a sense, they will not be without their effect in this country. The proposition reduces the large electrical manufacturing concerns in Germany to three, viz., the A.E.G., the Siemens-Schuckert and Bergmanns. To those who have followed the trend of events, it has long been evident that amalgamation or a pooling of interests was only a matter of time.

For many years there existed the Electroschutz-Kartell, which was instituted for the purpose of keeping up prices in the home market, and though we are assured that this electrical trust no longer exists among the present manufacturers, it cannot be overlooked that every step taken is leading to a position from which, at all events, it will be easy to make a permanent arrangement in regard to prices. It is true that the *Frankfürter Zeitung* speaking, we presume, on behalf of the A.E.G., states that there are considerations of a personal nature which would prevent any further progress towards unification, but, no doubt, we shall be forgiven if it is suggested that such statements should be taken with a large grain of salt. Without some such soothing statement there would no doubt be created in the minds of the German public genuine alarm at the formation of a gigantic trust. But such pains are taken on every occasion to demonstrate that no understanding can possibly be arrived at, that one becomes a little suspicious.

The action of the A.E.G. in taking over the control of the Felten & Guilleaume concerns is frankly intended to remove a dangerous competitor. The manifesto issued by the A.E.G. to the English financial Press is quite precise on this point, as will be seen from the following quotation :—

"The advantages derived by the A.E.G. are increased by the fact that by taking over the Frankfort dynamo factory it gets rid of troublesome competition, acquires with the

dynamo factory both material values and goodwill on favourable terms, obtains a fresh foothold in South Germany, and through the intimate connection of its cable works with the old Mülheim Carlswerk assumes the lead in the submarine cable trade. While the A.E.G. thus considerably strengthens its position, the combination will pave the way to renewed successful efforts on the part of the Felten and Guilleaume Co. by releasing it from the care of the dynamo factory."

It being then fully and freely admitted by the A.E.G. that the suggested combination is for the purpose of reducing competition, it is absolutely clear that its efforts towards an affiliation of interests are not exhausted by its recent action. It is true that we may not see a written record of the amalgamation of the three remaining interests, but our German neighbours are essentially business people, and without there being anything in the nature of an actual coalition, it is quite easy for them to make a pooling arrangement among themselves without the outside world being any the wiser. It must not be forgotten that the Kartell worked very smoothly for some years without the public being aware of its existence.

After all, one can hardly blame the German industries for entering into a series of transactions which will have the effect of reducing unreasonable and unhealthy competition. Social economists tell us that there can be no halfway house between competition and rapacious trusts; but if the combination of interests instituted by the A.E.G. does not raise prices to an unnatural level, we do not think that any fair-minded person can object to it.

It is true that the average prices in Germany for electrical machinery are considerably higher than those which obtain in this country, but it has never been suggested that the cost of electrical machinery in Germany is excessive. Everybody knows that German prices in England and in Germany bear no relation to one another, but that is a phase of the matter on which we shall subsequently make some comments.

In the meantime we shall assume that the pooling of interests in Germany is practically an accomplished fact, and we are not so much concerned with the effect of such an arrangement in Germany as in the markets in which the British manufacturers are competing. Without admitting any immediate cause for panic, there are certain elements which give us very considerable concern. For some years past the German electrical manufacturer has proved to be a very serious factor in England. Owing to some extent to the earlier development of electrical apparatus, German machinery has been widely adopted in this country. Cumberland can show us examples of pumping plant made on the Continent; the important coal mining industry of South Wales depends in a great measure upon German gas engines, turbines, winding plant, and haulage gears, and it is a notable, if somewhat melancholy fact, that probably the most important electrical scheme for colliery working in this country, namely, the Ferndale Colliery, was carried out by the Labmeyer Co., which, according to the statement of the A.E.G., has been incurring losses on its dynamo factory. The successes gained by the A.E.G. on the North-East coast are fresh in the minds of our readers. But while, as we have said, the larger experience of our German friends has helped them to secure work, their position has been mostly built up in this country by virtue of low prices and the financial support which they have given to various undertakings. The competition among the home manufacturers alone is sufficiently severe to keep prices on a non-remunerative basis, but the presence of the Germans under present conditions cannot but result in a permanent impoverishment of the industry.

With the strengthening of the German electrical manufacturers at home, they will be in a still better position to keep prices down in this country. It has been our conviction for years past that the aim of the German manufacturer was to cripple the English electrical industry, and unfortunately the British consumer, and to some extent the British consulting engineer, have aided very materially in this process. The electrification of the industries is the chief work remaining in England. But while there is much to be done here in collieries and steel-works, the most important markets are abroad, and the demand for electrical machinery will continue for a very considerable period in Australia, South America and Canada. Without, however, neglecting these markets, English electrical manufacturers should not overlook the very excellent opening for high-class electrical machinery to be found in Germany. It sounds an absurdity, but if a combination of British electrical interests could be effected for the sole purpose of exploiting Germany, we think there would not only be secured an excellent outlet for plant, but there would result a remarkable easing of the position at home. Whether such an arrangement could be effected we have no means of telling, but to our mind it would not require a very large fighting fund to carry the war into the enemy's camp. Not only would such an attack be of immense value at home, but it would have a far-reaching effect on the business situation in the Colonies and in other places abroad. The theory we advance is not novel; it has been put into actual practice by one of our large cable-makers, and we feel certain that this calculated action had some important results. Surely the English electrical industry is not so wholly crushed as to be unable to take advantage of the very large broadside which the Germans are presenting. The combination of German interests makes them stronger abroad, but it renders them more vulnerable at home. We suspect that the German purchaser is very much like the English—he would be always susceptible to a low price; and as in some respects the English standard machine is better than the German, there is reasonable hope that the pursuance of an active policy in Berlin on the part of English manufacturers would result in success. There would probably be no immediate profit, and there would be most strenuous opposition offered by the German manufacturer and his affiliated banks, but, after all, their influence is not paramount throughout Germany, and the very circumstances of the struggle would gain some customers.

QUO VADIS?

Events are moving so rapidly in the battlefield upon which the war between Capital and Labour is carried on, that all employers must regard the recent turn of events with considerable anxiety. Ere these words appear in print things may have improved; but the veriest optimist will admit that the outlook is as bad as it has been for many years.

It is not merely that a number of men have been locked out, and that others are likely to be in the same condition before long; strikes and lock-outs have come to be regarded as an almost necessary evil. If the masters and the representatives of the men have failed to agree in the past, that failure has resulted in a strike or a lock-out. But the gravity of the present situation lies in the fact that the men have openly flouted their leaders. The members of a strong Trade Union have refused to allow their executive to negotiate with the employers. As a result the employers do not know which way to turn.

Inasmuch as unrest in the labour world is notoriously infectious, it is more than likely that many other Unions of employers and workmen will become involved in the struggle, and neither the electrical industry nor any other department can well afford to face an upheaval of the labour market. It is hard enough to meet competition under normal conditions; but it becomes well-nigh impossible when master and man refuse to meet in friendly conclave to discuss their differences.

Assuming that the worse comes to the worst, that compromise on either side is refused, what will be the result? What powers, if any, can be invoked to enforce a settlement?

A study of the laws of England, in so far as they regulate the employment of labour, provides no solution to the question. The employer need not employ; the workman, if he keeps off the rates by hook or by crook, need not work. The Right to Work Bill has not yet become an Act of Parliament. Trade unionists may, by dastardly outrage, compel those who prefer to stand aside from these bodies to become members; but they cannot compel the employer to open his shop or obtain an injunction to restrain him from sending his orders abroad.

It must be presumed, of course, that the object of the trade unionist or of the workman who goes on strike is to increase the rate of wages. Any attempt of this kind involves an attack upon the wages fund of the country; and since the tendency of profits is to a minimum, an employer who is compelled to increase the amount which he is setting aside for the payment of wages must, of necessity, recoup himself in some other way. It is manifest, of course, that in particular cases, a body of workmen may have it in their power to increase wages. Assume, for instance, that an employer is under penalty to complete a piece of work by a certain time, he is at the mercy of the workmen, unless they can be replaced by others who are prepared to accept what he is willing to pay. And even where there is no penalty clause, it is obvious that anyone who has embarked his capital upon a particular venture, must either accede to the demands of those whom he employs, or else submit to the postponement of the day when he will get a return for his outlay. A temporary benefit, therefore, can be obtained by a strike or even by the threat of a strike, but that benefit will only accrue to a comparatively small proportion of the wage-earning classes. But what of the larger interests at stake? How will the capitalist and the employer recoup himself? If, by reason of an increase in the wages bill, profits are materially reduced, the tendency will be for the capitalist to withdraw his capital by degrees and employ it elsewhere. After a little the successful workmen will find that their services are not required, and will be compelled, in order to support themselves, to go into the general labour market.

Of course, if trade is good and profits are large, it may well be that the action of a trade union will compel an employer to pay the higher rate. In the Newcastle engineering strike, for instance (which took place many years ago), it was admitted, on the side of the masters, that the conditions of trade from the beginning permitted an advance of wages; yet no advance was proposed until the pressure of Trade Unionism was brought to bear.

As Mr. Cairns has remarked in his "Political Economy," "The temporary success of a strike does not necessarily prove its wisdom; but the failure of a strike, immediate or ultimate, is decisive evidence that it ought never to have been undertaken."

Trade Union leaders, who would do the best for their followers, have frankly recognised the impossibility of forcing profits permanently below the rate which capitalists regard, and show by their conduct that they regard, as only an adequate return for their outlay; and they must organise the means for obtaining sufficient and trustworthy information respecting the actual state of trade, with a view to determining whether profits are, or are not, in advance of this minimum level. Unless they are guided by these principles they may lead their followers into disaster.

It is only by slow degrees that the responsible leaders of the men have come to believe in these elementary principles of political economy. To instil those principles into a rabble of discontented workmen is a task which is little short of hopeless.

It is manifest that the ordinary weapons which avail the executive of a union are quite useless on this occasion. The expulsion of 10,000 members from a union which numbers 15,000 is ludicrous. The prospect of forfeiting sick and benefit pay has no terrors for the young and lusty, who can always command good pay when they are in work. Remedies by civil action in the law courts there cannot be, as no contracts have been broken. If the employers are united and remain firm, there can only be one end to a dispute between capital and labour.

But the men, who have power to protract a hopeless struggle, should take warning that the foreigner is on the watch. They may be usefully reminded of what happened in the Welsh slate trade. A long and bitter struggle occurred in the Penrhyn quarries. The employer stood firm. He would brook no interference from Trade Union officials. That was the point which he desired to gain, and he did gain it at last. The men held on to the end, believing that when they chose to return to work, there would be plenty of employment. But the demand for Welsh slates had seriously diminished as a result of the strike, owing to the fact that the builders had to look abroad for slates. By this means the foreigner secured a footing which he has ever since retained.

The tide of revolt has not yet reached the electrical industry, but it may do so at any time. We trust that all those working men who have the welfare of that industry close at heart, will place confidence in their leaders. It is with those leaders that the employers are able to deal, and to make terms satisfactory to all parties.

The Cost of Underground Wires.

Interesting figures as to the relative costs of overhead and underground telephone wires were brought to light in the recent case of Mayor of Croydon *v.* the Postmaster-General, which has been decided by the Railway and Canal Commission. It appears that in this borough the municipal authorities have an objection to overhead wires, upon what appear to be for the most part purely æsthetic grounds. As a result of this, the Postmaster-General has already had to put in underground lines at a cost of £65,000, as compared with only £1,800 for overhead lines. He has, however, done all that he thought was required of him in this regard, and a short time ago he refused to put in certain underground wires at a cost of £726 17s. 7d., this being 355 per cent. more than they would cost if put up on the overhead system. The Corporation had recourse to the legal tribunals. The County Court judge held that the Postmaster-General was in the right, and the Railway and Canal Commission have affirmed his decision. Here are some of the objections put forward by the Corporation: (1) That overhead wires tend to lower letting values; (2) that they disfigure roads; (3) that they are dangerous in times of storm and tempest; (4) that they are a nuisance and a disturbance to domestic peace and comfort, by reason of the noise caused by the vibration of the wires; and (5) that they are obstructions to the traffic, and dangerous on that account. The Borough of Croydon must have been hard put to it if it was really necessary to base their case upon arguments such as these. Fifty years ago they might have had some effect, but the public have long become accustomed to overhead wires. If such objections were to prevail at the present day, it would, indeed, be difficult for the Postmaster-General to promote the use of the telephone upon terms agreeable to the public. The decision of the Railway Commissioners, that if the ratepayers of Croydon desire to use underground cables they may themselves have the privilege of paying for them, is altogether sound. As Mr. Justice A. T. Lawrence said, "It is all very well to desire to preserve the æsthetic condition of Croydon, but Croydon must think of its utilitarian purposes as well, and it is necessary that the telephone system should be adopted with greater frequency than at present."

THE BRITISH ASSOCIATION MEETING AT SHEFFIELD.

Section B.

Although, perhaps, the amount of work got through by the Chemical Section was below the average, there were a few papers read of special local interest, and the Section took part in several instructive discussions, including that on "The Relation of Science to Industry and Commerce," to which we refer in another column.

By a happy choice, the Presidential chair at this meeting, in the birthplace of Dr. Sorby, the father of the micro-photographic examination of metals, and in the centre of the great steel trades, was occupied by Mr. J. E. Stead, F.R.S., whose opening address took the form of a discussion on "some of the underlying phenomena connected with the effect of sulphur and silicon on the carbon condition of commercial cast-iron."

On the Friday the Section held a joint meeting with Section A to receive a report from Prof. Bone on "Combustion," and a number of other papers of common interest to the two Sections. Prof. Bone's report gave rise to an interesting discussion, which was taken part in by a number of eminent members of both Sections, and showed clearly the difficulty experienced by the physicist and the chemist in finding a common point of view.

Monday was devoted to two discussions, the one with the Education Section, the other with Sections K (Botany), and I (Physiology), on the "Bio-Chemistry of Respiration."

Tuesday, alone, was devoted to what may be termed the regular work of the Section, when it met in two parts to listen to a number of papers on organic chemistry and metallurgy respectively.

In a paper on "Ferro-Silicon: the Causation of Dangers Incidental to its Transport and Storage," Dr. Copeman pointed out that this alloy of iron and silicon, when it contains certain percentages of silicon, is liable to explode during handling or transport in closed iron drums. A more common danger is that of illness or death caused by gases evolved from cargoes of this material. As many tons are annually imported into this country for use in the manufacture of steel, great inconvenience was caused by the refusal of shipping firms to accept it as cargo.

The Board of Trade have now issued Regulations founded on the results of Dr. Copeman's investigations, and these, it is expected, will prevent the occurrence of accidents during the transport of ferro-silicon.

In a paper on "The Closing and Welding of Blow-Holes in Steel Ingots," Prof. H. M. Howe, LL.D., discussed the practice of favouring the formation of blow-holes in the casting of steel ingots with the object of avoiding the formation of a "pipe" or central cavity. There is a divergence of opinion amongst metallurgists as to whether these blow-holes can be got rid of completely during rolling by welding. The author considered that the diffusion of the gases forming the blow-hole and the welding up of the sides of the blow-hole are promoted by the practice of partly rolling the ingot, reheating the resulting "bloom," and then completing the rolling, rather than by rolling the ingot out to its final shape after only one heating.

Other papers of local technical interest were read by Prof. Arnold on "A Fourth Recalescence in Steel;" by Prof. McWilliam on the "Influence of Chemical Composition and Thermal Treatment on the Properties of Steels," and by Dr. Rosenhain, who described experiments on the deformation produced by the application of stresses to iron and steel at high temperatures.

This Section was favoured also with a paper by Prof. Armstrong on "The Provident Use of Coal." The Professor complained that as used in domestic fires and the manufacture of gas, coal is largely wasted. When burned as such much of its value escapes up the chimney and adds to the smoke nuisance, whilst when subjected to destructive distillation at a high temperature to produce the maximum amount of gas, the coke produced is unsuitable for domestic use. Moreover, since the repeal of the sulphur clauses of the Gas Act, the quality of the gas supplied by the gas companies has steadily deteriorated. If the use of gas for heating purposes is to be largely extended, the quality of the gas must be improved, and especially the amount of sulphur in it diminished. This can be accomplished by coking washed coal, and if the coking were carried out at a low temperature, the gas given off would be valuable both for illuminating and heating purposes, and the resultant soft coke would be suitable for burning in domestic fires.

During the discussion, it was pointed out that the process of coking at low temperature is not new, and that the whole matter is one of £ s. d., whilst on behalf of the gas companies, Mr. Oak claimed that they were doing all they could to conserve coal by getting as high as possible a yield of gas and selling at a low price, both for lighting and heating purposes. Prof. Armstrong, in reply, said that the bad quality of modern gas had forced him against his wish to introduce electricity into his house.

Educational Problems.

A most valuable address was delivered in the Educational Science Section by Principal H. A. Miers, M.A., D.Sc., F.R.S., President of the Section.

The function of a University, its likeness to and its difference from the function of a school, and the difference in teaching methods which must occur when the student passes from the school to the University, afford a theme upon which Dr. Miers has prepared an important and highly interesting address.

School education should be directed towards training the mind, towards equipping the pupil with the mental tools which he will need to use at the University. The school teacher's object should be to teach facts, so that, when the scholar takes up University work, his knowledge should be general, his mind prepared, and his whole faculties in a state in which they may be led and directed to a high condition of excellence in the subjects which he determines to make his own.

As Dr. Miers points out, in many instances the last days of school training and the first days of University training overlap. He declines to consider at any great length how to avoid this, and proceeds, to use his own words, "to decide what should be done at school and the University respectively before discussing how the examinations are to be adapted to our purpose." The matriculation examination, he observes with regret, has tended to become a test of knowledge rather than a test of general intelligence, thus encouraging specialisation. Specialisation at early ages should be avoided. It is true that in modern life the necessity for specialisation increases. The man whose lot is cast in a particular department of business has not sufficient time at his disposal to acquire a great deal of knowledge concerning other subjects. In fact, the general manager of a large commercial undertaking must himself specialise in generalising. He cannot take up the work of one particular department. With a good general manager, efficiently controlling good departmental managers, who in their turn efficiently control their own departments, a business organisation will in all probability be highly successful. But a boy or girl at school must not be encouraged to specialise at all. Generally a pupil has his pet subjects and his pet aversions, but he should not be allowed to cultivate the former exclusively, and to neglect the latter entirely. It is necessary, during school years, to train the mind so that it can afterwards take up any branch of learning with practically equal facility.

When the student reaches the University, those who are teaching him are related to him in an entirely different way to that in which his school teacher stood with regard to the same pupil. The University lecturer guides, but does not drive; he leads, but can hardly be said to govern, his class. He is a leader among equals—or at all events he is a leader among those who hope and intend to become, and in the majority of cases do become, his equals.

Much depends upon the student's individuality. Some boys and girls will be fit for the University years before others. It is therefore impossible to say that at a certain definite age school must cease and the University must begin. It is difficult to see how overlapping can be entirely avoided. A brilliant lad of 15 is not really fit for the University, and

a slowly-assimilating boy of 18 or 19 certainly ought to have left school. Is it not, therefore, a good thing that there should be a kind of intermediate stage between school and the University? As it was once put by a schoolmaster: "In the sixth form every boy ought to become a student." In other words, in the sixth form the brilliant boy matures his body, and the dull boy matures his mind. The average boy goes straight on.

Having established the principle that when a student reaches the University he should have fair mental training and sufficient intelligence, Dr. Miers goes on to inquire what should be the relation between one teaching and the other. He points out that when a pupil leaves school and immediately enters a profession or business, he leaves behind him all disciplinary exercises and preparatory courses, and embarks upon work which has a purpose behind it. In the University this should also be the case, but sometimes it is not. Illustrating his argument by taking as an example the subject of history, Dr. Miers shows that at the University the student should learn at once how to use the original sources. The spirit of inquiry should be roused, and if a University teacher is not rousing this spirit and keeping it alive, he is not realising the University ideal.

Dr. Miers points out that among original investigators and researchers there are two quite distinct types of mind, the one pursuing his investigation with a constant purpose, who is inspired by that purpose, and the other eternally thirsting for novelty, pursuing first one line of investigation, tiring of it, and then pursuing another totally different line. These two types of mind have achieved equally valuable results, but for ordinary students the first-named type of investigator is the safer guide.

"The principle which I am advocating is . . . . that the business of direct mental training should be finished at school, and that at the University the trained mind should be given material upon which to do responsible work in the spirit of inquiry. Preparatory exercises belong to school life and should be abandoned at the University."

To secure this result it is desirable that the professors and higher teachers at the University should be actively engaged in investigation. Their assistants should also have had some experience in research. The parallel is drawn that as the elementary teacher must have had some education in method, so research is necessary to the University teacher. The need of post-graduate scholarships is keenly felt in reference to this point. There must be at a University an atmosphere of investigation. At school no subject should be taught to a class as though it were intended to be their life work; at the University each subject should be studied as though it really were the life work both of teacher and student.

A somewhat strange circumstance is noted by Dr. Miers. In considering what sort of school education affords the best preparatory training for the University, he gives, as the experience of many teachers, including himself, that if a boy is capable of taking up at the University a course which is entirely different from his school course, he will generally be found to have come from the classical side, and not from the modern side. This suggests that a literary education at school is at present a better intellectual training for University work than a scientific education. Reasons suggested for this are that the brighter boys are retained on the classical side, the slower being left to find their way to other subjects, that some whose real tastes have been suppressed at school turn zealously to new work; but Dr. Miers thinks there is a lack of human interest in the teaching of elementary science—that the personal side of the story of discovery, which is too much neglected, might be used to give some insight into the working of the human mind and character, and would form an introduction to the philosophy of science which is at present so strangely ignored by most teachers.

Then Dr. Miers deals with the subject of the use of language. "I believe," he says, "that the practice of expressing thoughts in carefully chosen words, which forms so large a part of a good literary education, constitutes a mental training which can scarcely be surpassed." He laments that in examinations a pupil who appears to understand a problem is often allowed full credit, even though his spoken or written answer may be far from clear. This is a great mistake. Of course, in examinations a student sometimes tries to conceal a vast ignorance in a cloud of words. This is a kind of effort to bluff the examiner, and may fairly be considered part of the game. Somebody said that speech was given to man to conceal his thoughts. Speech and writing may both be used, and frequently are used to conceal the fact that their author has no thoughts at all. But even when a man knows his subject from A to Z, how often do we find that he cannot write half-a-dozen words about it? Especially is this the case among engineers. The study of great writers and masters of style does not do everything. Men who read much, and that very carefully, who are really well informed, who can talk in private upon, say, an historical subject, with vigour and ripe knowledge, are frequently found, as Minto expresses it, to dip their pens and cudgel their brains in vain if they wish to write down some of their learning. Training and practice alone will overcome this. The business man may profitably spend a little more time on the composition of his letters; the habit, now so common, of directing the typist to write a letter in a certain sense, should be dropped and discouraged. The mental training of composing and either writing or dictating a decently worded letter is excellent. Besides, if all the letters are composed by the correspondence clerks, where is there any individuality about them?

There is much to be said in favour of sending an engineering student from school to the works, and after a year or two there from the works to the technical college or University, as the case may be. At the University the student works from ten till five, and lounges at his work if he wants to. At the works the hours are more likely from seven till six, and lounging is prohibited, and overtime must be worked when ordered. This training, partly bodily and partly mental, would so prepare the student to devote all his energies to his work, that his University course would then acquire its maximum efficiency. He would feel that sense of responsibility about his work which Dr. Miers points out to be so desirable. He would realise *why* he was required to do certain things, and wherein the application of his theoretical work lay.

Dr. Miers's address provides much food for thought on the part of both teachers and students. We wish all who are interested in the subject at all could study it carefully, especially that part which deals with the matter of the proper use of language. To this point it is difficult to assign too much importance. A German was once heard to observe: "You ordinary English people only use about two dozen words to express all your thoughts." The vocabulary of most people is certainly too limited, and attention should be paid to this defect.

If there is one thing in Dr. Miers's address which we regard as more important, not only to scientists but to all educated people, than any other, it is the line of thought which may be summed up in these words:

"English people, learn to use your own language!"

Experiments for Improving the Construction of Practical Standards for Electrical Measurements.

Abstract of Report of the Committee, consisting of Lord Rayleigh (*Chairman*), Dr. R. T. Glazebrook (*Secretary*), Profs. J. Perry, W. G. Adams *and* G. Carey Foster, Sir Oliver Lodge, Dr. A. Muirhead, Sir W. H. Preece, Profs. A. Schuster, J. A. Fleming *and* Sir J. J. Thomson, Dr. W. N. Shaw, Dr. J. T. Bottomley, Rev. T. C. Fitzpatrick, Dr. G. Johnstone Stoney, Prof. S. P. Thompson, Mr. J. Rennie Principal E. H. Griffiths, Sir Arthur Rucker, Prof. H. L Callendar, *and* Messrs. G. Matthey, T. Mather *and* F. E Smith.

(*Section A.*)

The Report of the International Conference on Electrical Units and Standards, held in London in October, 1908, was printed as an Appendix to last year's Report.

In January, 1910, the Board of Trade took action in accordance with the recommendations of the Report, and an Order in Council relating to electrical units, dated January 10th, which contains definitions of the English standards of resistance, current and electromotive force, in conformity with the definitions adopted by the Congress, has been issued.*

In accordance with a scheme approved by the International Scientific Committee appointed by Lord Rayleigh at the London

* Electrical Review, January 14th, 1910.

Conference, international co-operative work on electric standards has this year been carried out at the Bureau of Standards, Washington. It was arranged that representatives of the Bureau of Standards, the Laboratoire Central d'Electricité, Paris, the Physikalisch-Technische Reichsanstalt, Berlin, and of the National Physical Laboratory, should take part in the work. The representatives of the Bureau of Standards were Prof. E. B. Rosa and Dr. F. A. Wolff, and the European delegates were Prof. W. Jaeger, Prof. F. Laporte and Mr. F. E. Smith.

Prof. S. W. Stratton kindly offered the facilities of the Bureau of Standards for the investigation, and, in his capacity as treasurer of the International Committee, was able to secure the funds to defray expenses. Towards this object the governing bodies of the American Institute of Electrical Engineers, the National Electric Light Association, the Association of Edison Illuminating Companies and the Illuminating Engineering Society most generously subscribed £100 each. Some smaller contributions were also received.

The primary object of the meeting was to determine the electromotive force of the Weston normal cell in terms of the international units of resistance and current. At the same time it was necessary to clear up certain outstanding problems on the standard cell and the silver voltameter. Previous to the meeting, a great deal of experimental work had been done at each of the four institutions, and the results obtained were compared before deciding on a programme of experimental work.

The European delegates took with them from their own laboratories a considerable quantity of apparatus and chemicals, together with standards of electromotive force, resistance and mass. The results of the meeting are very valuable, and a full report is in process of preparation.

Another careful research on the silver voltameter has been made during the year by Prof. F. Laporte at the Laboratoire Central d'Electricité. Prof. Laporte shows that the result obtained in 1908 by Profs. Janet, de la Gorce and himself, is subject to an appreciable error, owing to the use of silver nitrate, now known to be impure. With carefully prepared nitrate, and using the Rayleigh form of voltameter, he obtains 1·11829 milligram per coulomb for the electro-chemical equivalent of silver, the current being measured in terms of the Weston cell as 1·01830 volts at 17° C., and the international ohm as realised at the National Physical Laboratory. The unit of current was, therefore, the same as that used by Smith, Mather and Lowry in 1908, and the value for the electro-chemical equivalent found by Prof. Laporte is in very close agreement with the value 1·11827 obtained by the British investigators.

With regard to progress in electrical standardising work at the National Physical Laboratory, the Lorenz apparatus is practically complete, and some preliminary electrical measurements will, it is hoped, be made in October of the present year.

The Ayrton-Jones current balance continues to work most satisfactorily; small and gradual changes in E.M.F. of Weston cells, amounting to less than three parts in 100,000, have been detected by its aid.

The results of the investigation on cadmium amalgams at the National Physical Laboratory were incorporated in a paper read before the Physical Society last February. It may be useful to give here the limits of temperature between which various amalgams may be most usefully employed in the Weston normal cell:—

Percentage of cadmium in the amalgam.	Lower limit.	Upper limit.
6 ...	below 0° C. ...	about 27·7° C.
8 ...	„ ...	„ 41·0°
10 ...	„ ...	„ 51·0°
11 ...	about 0° C. ...	„ 56·0°
12 ...	„ 8·7° C. ...	„ 60·0°

The degree of reproducibility which is now obtainable with the Weston cell far surpasses what it was five years ago. At the National Physical Laboratory 67 cells were tested in 1909, and of these 60 agreed with the Laboratory standards within one part in 10,000. What is not understood at present is the occurrence of strange hysteresis effects in a few cells. The E.M.F. of such cells may be normal at first, but changes comparatively rapidly with time. Indeed, a large hysteresis effect in a cell appears to be an indication that the E.M.F. will not remain constant with time, whereas its absence is in general an indication of constancy.

In view of the fact that the republication of the Reports is not yet completed, the Committee recommended that they be reappointed, that Lord Rayleigh be chairman, and Dr. R. T. Glazebrook secretary.

The Cyclical Changes of Temperature in a Gas Engine Cylinder near the Walls.

By Prof. E. G. Coker, M.A., D.Sc.

(*Section G. Abstract.*)

Experiments described in *Engineering* for October, 1908, show that the temperature at the inner surface of a small gas-engine is about 240° C., and the cyclical variation is usually less than 10° C. The steady conditions of low temperature at the wall-surface are maintained by the jacket-water, although the explosion of the gaseous mixture produces very great changes of temperature close to the walls.

This variation has not hitherto been measured for a complete cycle owing to the difficulties which occur in measuring the highest temperature of the explosion. In order to obtain the cyclical variation near the walls, a couple was made of an alloy of 10 per cent. iridium and platinum, with a pure platinum wire, and this was secured in a metal plug so that it projected ¼ in. into the cylinder. On light loads and weak mixtures the cycle remained unbroken, but near full load the platinum wire melted.

Couples made from 10 per cent. alloys of iridium and rhodium with platinum were afterwards used, having an electromotive force E above 500° C. given by $E = -174 + 7{\cdot}6075\ T - 0{\cdot}00167\ T^2$, where T is the temperature Centigrade. The junctions were rolled down to five or six ten-thousandths of an inch thickness and inserted at a depth of ½ in. from the cylinder wall. These couples were able to withstand the highest temperatures near the walls, and they were not melted except during abnormal explosions.

Measurements of the cyclical variations showed a variation of E.M.F. lying between 1·56 and 7·83 milli-volts with an average cold junction temperature of 30° C. The temperature variation corresponding to these values ranges between 250° C. and 1,700° C. The conclusion is reached that the temperature at the place of measurement has a maximum value between 1,850° and 1,900° C.

Magnetic Observations at Falmouth Observatory.

Abstract of Report of the Committee, consisting of Sir W. H. Preece, (*Chairman*), Dr. R. T. Glazebrook (*Secretary*), Prof. W. G. Adams, Dr. Chree, Capt. Creak, Mr. W. L. Fox, Sir Arthur Rucker, *and* Prof. Schuster.

(*Section A.*)

The results of the magnetic observations at Falmouth Observatory for 1909 have been published in the annual report of the National Physical Laboratory, as well as in that of the Royal Cornwall Polytechnic Society. The mean values of the magnetic elements for the year are:—

Declination	17° 48·4′ W.
Inclination	66° 30·6′ N.
Horizontal force	0·18802 C.G.S.
Vertical force	0·43266 C.G.S.

During the year the magnetic survey ship *Carnegie* visited Falmouth, and was furnished with data of great value. An account of some of the results is given in a paper by L. A. Bauer and W. J. Peters "On the Complete Magnetic Results of the First Cruise of the *Carnegie*, 1909-10," published in *Terrestrial Magnetism* for June, 1910.

The magnetographs at Eskdalemuir are now working satisfactorily, and it is hoped it will be possible to commence this year the regular tabulation of results. By an arrangement recently made between the Royal Society, the Meteorological Office and the Treasury, the responsibility for the magnetic and meteorological work at Kew and Eskdalemuir now rests with the Meteorological Office. The Committee therefore recommend that the name of Dr. Shaw be added to the Committee, and that he be the secretary of the Committee.

Vacuum-tight Seals between Iron and Glass.

By Henry J. S. Sand, Ph.D., D.Sc.

(*Section A. Abstract.*)

Some cathode-ray tubes were shown in which a vacuum-tight seal between iron and glass has been obtained as follows: An iron wire is sealed into a glass tube. While the glass is hot a small piece of heated steel tube surrounding the wire is pushed a few millimetres into the glass. After cooling the tube is soldered to the wire. The vacuum-tight seal is produced between the inner surface of the elastic steel tube, which on cooling is put under tension, and the glass which comes under compression. Seals with wires of 1 mm. dia. have been produced in this way.

On the Direct Measurement of the Rate of Air or Gas Supply to a Gas Engine by Means of an Orifice and U-Tube.

By Prof. W. E. Dalby, M.A., M.Inst.C.E.

(*Section G. Abstract.*)

An orifice in conjunction with an anemometer was used to measure the air supply at the Ashton trials of the Committee of the Institution of Civil Engineers, and more recently Prof. Ashcroft contributed a paper to the Institution of Civil Engineers describing a method of using an orifice in conjunction with a specially designed indicator to measure the difference of pressure on the two sides of the orifice. The gas engine used by the author is fitted with apparatus by means of which the temperature corresponding to the pressure and volume at an assigned crank-angle can be accurately measured with a platinum thermometer. Thus all the data are observed from which the weight of air drawn through the orifice per cycle can be computed. A relatively small orifice is used—so small that the difference of pressure on the two sides of it is equivalent to about 1 ft. of water under normal conditions of running. This difference of pressure can then be measured by means of a U-tube, and small variations of head are easily observed. Numerous experiments have established the fact that the coefficients of the orifices tried are practically constant and equal to 0·6. The gas supply can be measured through an orifice in the same way. Hence the mixture of air and gas passing into the cylinder can be obtained from two readings, with suitable corrections for density, at any time during the run. The orifices, in combination with their U-tubes, become rate measurers, the one giving the rate at which air is supplied to the engine, and the other the rate at which gas is supplied.

THE UTILISATION OF EXHAUST STEAM.

An interesting example of the utilisation of exhaust steam, and of the advantages of co-operation between waste heat owners and electric power companies, is to be found in the waste heat station installed at Messrs. Sir B. Samuelson's Ironworks, Newport, Middlesbrough. In this station exhaust steam from blast-furnace blowing engines is collected, and after being superheated is passed to exhaust steam turbines driving alternators which are coupled up on the electrical side to the Cleveland and Durham Electric Power Co.'s mains, which transmit the power to its consumers throughout the district.

This article illustrates the latest addition to the plant in this station, which consists of two 1,250-kw., three-phase, 40-cycle, 6,000—6,600-volt turbo-alternator sets running at 2,400 r.p.m. The turbines, fig. 1, are of the double-flow reaction type, in which the steam is expanded from atmospheric pressure to condenser pressure. With this type of turbine there are no dummies or balance pistons, which, requiring small clearances, are liable to cause trouble, while the blading proportions are maintained at a very efficient state throughout.

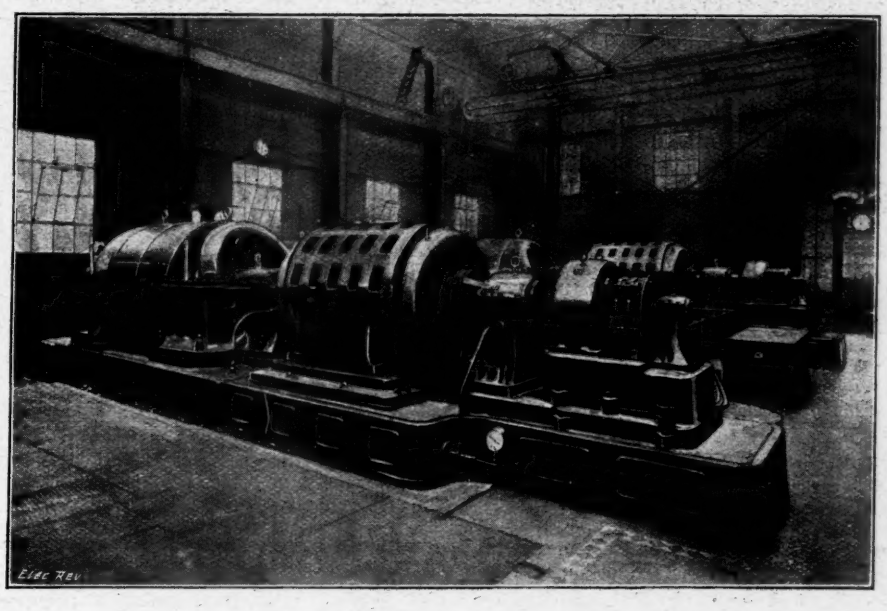

Fig. 1.—Exhaust-Steam Turbo-Generators, Newport.

The glands are of the well-known Westinghouse water-sealed type, but arranged for operating with steam in the event of the water supply failing through any cause, and also for starting up. The superiority of water as a packing is evidenced by the entire absence of steam leakage from the glands and of heating-up of the journals by conduction along the shaft: the amount of attention called for is also very small.

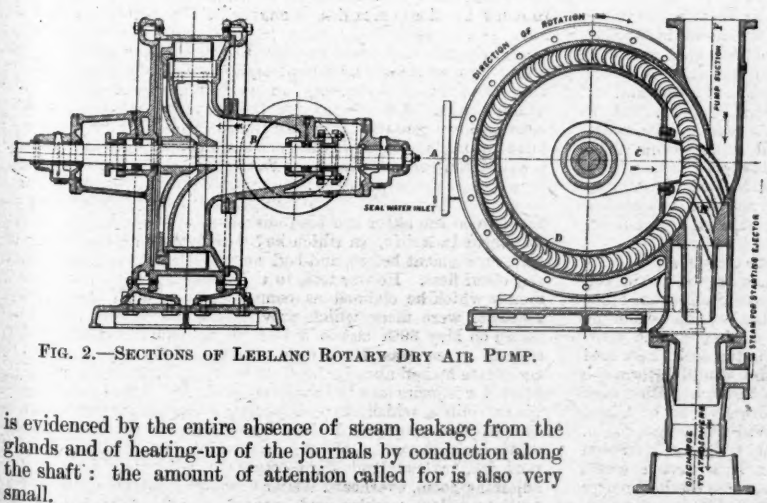

Fig. 2.—Sections of Leblanc Rotary Dry Air Pump.

The whole installation has been specially designed with a view to giving the greatest simplicity, and the valve gear has been given special attention in this direction. The governor is of the centrifugal type, driven direct through a worm wheel and shaft from the turbine spindle, and controls the valve admitting steam to the turbine.

The stop valve is of the ordinary gate type fitted in the steam pipe immediately before the turbine; the so-called turbine steam chest is therefore of the simplest nature. Two methods are provided for shutting down the turbine in case its speed should tend to rise above 10 per cent. over normal, one incidentally closing the governor valve, and the other opening up a large air connection to the condenser and so destroying the vacuum, without which the turbine cannot operate.

The turbines exhaust direct into surface condensers placed directly beneath them. As the air pumps are of the Westinghouse-Leblanc type, and the hot-water extraction pumps of the two-stage centrifugal type, there is not a single instance of reciprocating motion in the whole plant. Circulating water for condensing the steam is drawn from the River Tees and delivered through the Power Co.'s pipes to the condenser, and elaborate arrangements are made to enable the condenser and pipes to be quickly freed from mud or foreign matter which may have been deposited in them. These condensers maintain on regular full-load service a vacuum of 29 to 29½ in. with 30-in. barometer. The Leblanc air pump is sealed with water contained in a small tank in the basement, the pump itself being driven by a squirrel-cage motor directly connected to the air-pump shaft. Fig. 2 is a section through this type of pump, and fig. 3 shows the arrangement of the plant. In order that a check may continually be kept on the steam consumption of the turbine, the hot-water extraction pump is arranged so that it delivers into a special measuring tank in the basement, from which tank the water is returned to Messrs. Samuelson's works. The hot-water extraction pump and lift pump for this purpose are driven in tandem by a squirrel-cage induction motor.

The electric generators are of the two-pole, revolving laminated-field type, capable of giving a continuous output of 1,875 k.v.a.; these generators are similar to several others installed in various stations belonging to the Cleveland and Durham Electric Power Co., Ltd.

The whole of this plant has been manufactured and supplied by the British Westinghouse Co., Ltd., Manchester. The station has been built to the designs of the company's consulting engineers, Messrs. Merz & McLellan, and to the order of the Tyneside Development Co., the contractors to the Waste Heat and Gas Electrical Generating Stations, Ltd., whose property it is.

These turbines were placed in commercial operation a month or two ago, and on the recent official tests, the guarantees, though of a very stringent nature, were met, the

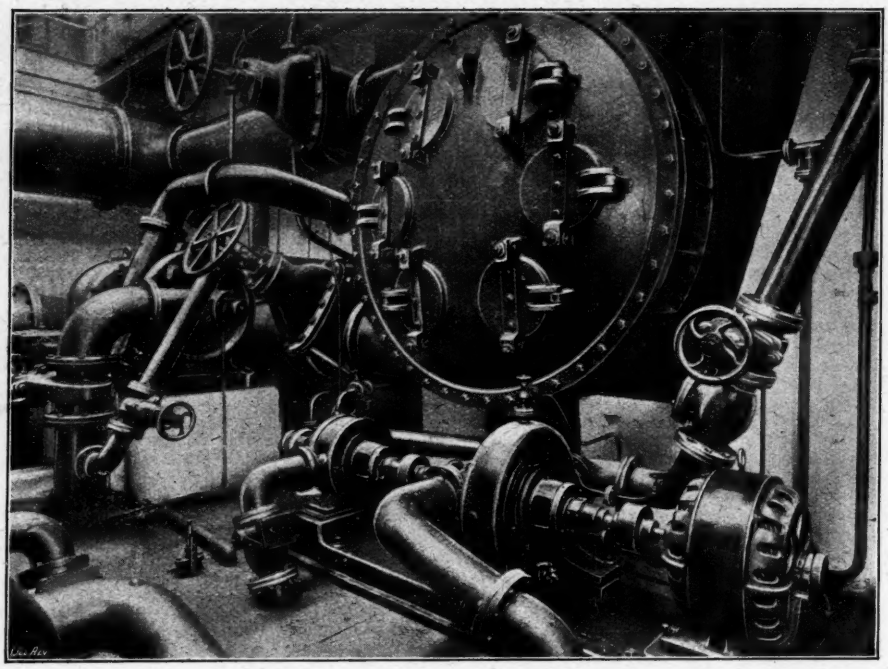

Fig. 3.—View of the Condensing Plant.

guaranteed steam consumption being 27 lb. per kw.-hour with steam at atmospheric pressure, superheated 50° F., exhausting into a vacuum of 28·8 in., with 30-in. barometer.

LEGAL.

Bogus Compensation Claims.—Sentences.

At the Old Bailey on the 9th inst., three men, named Geo. Weller, Henry Smith, and Ben Hodder, were sentenced to six months, four months, and one month respectively with hard labour in each case, for obtaining money by false pretences and for conspiracy to attempt to obtain money in connection with compensation claims for bogus accidents.

The prosecution was at the instance of the British Electrical Federation, and was in connection with the Metropolitan Electric Tramways, Ltd., operating in the north and north-west London districts. Mr. J. Ratcliffe Cousins, instructed by Mr. Hugh C. Godfray, prosecuted, and gave an interesting outline of the operations of the prisoners, who are part of a gang which has been perpetrating these fraudulent claims for the past five or six years. The leader of the gang was Weller, who had a permanent injury to his right wrist, and with this asset he has been able not only to earn a good living for himself, but has assisted other members of the gang to obtain considerable sums of money from insurance companies, brewery companies, tradesmen and others, in addition to the tramway company.

So far as the Tramway Company's claims are concerned, Weller's method was to board one of their cars and secure a seat on the top deck. When the car got to its destination he would allow the other passengers to alight, when by means of some weapon which he carried in his pocket, he would break away a piece of the wood slatting or beading which was nailed across the top deck; he would then pretend to fall, and proceeding downstairs would inform the conductor that he had met with an accident through falling over the defective slatting. His name and address would be taken, and in due time his claim would be received for compensation. Weller would, in the meantime, attend one of the many London hospitals, where the practice is as follows: If a person wants medical attendance as an out-patient, he simply sees the hall porter and states the nature of his injury, the porter fills in a form recording this injury, and with this the patient is directed to attend the house surgeon at the out-patient department between certain hours for treatment. Hitherto these documents have been regarded as certificates showing that the claimant was actually suffering from the injury stated. It is clear, however, that a fraudulently-disposed person could get any kind of injury inserted in the document, and without further trouble make use of the same in promoting the claim against his victims.

From the evidence given by the police, Weller has successfully carried on this practice for a number of years by simply appearing at different hospitals under different names, and at intervals securing a fresh document when required. The other members of the gang came into the conspiracy from time to time, as it was obviously impossible for Weller to appear more than once at the offices of the various firms he defrauded, without fear of detection. He conspired, therefore, with the other prisoners that he would, when necessary, give their names and addresses as his own, and when the company or firm on whom he claimed sent their representative to interview the claimants, Weller had meantime bandaged their right arms in correct hospital fashion and provided the conspirators with this useful hospital document in order that the chain of evidence might be complete. As the sum claimed was usually small, varying from £2 to £15, it was an easy matter for the frauds to be successful. In the case of the Metropolitan Tramway Co., they had in one accident a report from the conductor of the car in which Weller travelled, and also a detailed report from an inspector who happened to be travelling on the car at the time of the alleged accident; and when the company's representative saw the prisoner Hodder he was bandaged up in this fashion, and produced this hospital document in his own name, stating the injury as a fractured right wrist. The whole case appeared to be genuine, and a prompt settlement was made, in order to avoid legal proceedings, which were threatened unless the company agreed to pay quickly.

Although the British Electrical Federation, Ltd., were only victimised in a few cases, they considered it their duty, in the interests of the public, to institute these proceedings; as, although several of the large insurance companies in London had been aware that a gang had been at work for some years past, and they had been victimised to a much greater extent, they had been unable so far to detect the offenders. The fraud was discovered in the following manner:—

Weller, writing in the name of Smith, from an address at Walthamstow, informed the Metropolitan Tramways that he had met with an accident on June 20th last, and intimated a claim for compensation. A report had in the meantime been received from the conductor of the tramcar, and these documents were in due time forwarded to the department which deals with all the claims received by the companies belonging to the federation, and who have a mutual accident fund in operation. The claims officer made inquiries, and discovered that a similar claim had been settled a few days previously by a local tradesman, the claimant being of the same name, but giving an address at Wood Green. This address happened to be that of the the prisoner Hodder, who had been paid compensation some six months previously for an accident identical in its nature with the one now claimed for. In response to a letter, Weller called at the Federation Offices and was interrogated about the accident; he produced the hospital document describing the nature of his injury, and it was then noticed that the date on the latter had been altered. He was induced to make a statement in writing in which he asserted that he had never met with an accident before, and had never been paid compensation by any other firm. He was told to come back again to receive the money which he claimed as compensation, and in the meantime inquiries were made which proved that the certificate had been issued on May 30th last to Weller in the name of Smith, but the address given was Wood Green and on the strength of this certificate he had already been paid compensation by a local outfitter, for injuries said to have been sustained through falling over his sun-blinds, which were projecting at the doorway of his shop. It was also ascertained that his statement was false in other particulars, and when he appeared at the Federation Offices the next day, two Scotland Yard detectives, who were present in an adjoining room, overheard Weller repeat the false statements made on the previous occasion, and he was arrested. On being searched, documents were found in his possession, which led to the arrest of Hodder, who made a confession showing how the conspiracy had been worked. Smith was meanwhile actively engaged in endeavouring to obtain money from tradesmen in other accidents for which Weller had provided him with the useful hospital document, and he was in due time arrested.

A warrant was obtained for the arrest of a fourth member of the gang, but he had in the meantime learned of his confederates' arrest, and he has disappeared.

There is no doubt that the publicity given to the cases in which these men have been concerned will have a useful effect, and, in passing sentence on the prisoners, Judge Rentoul stated that if the Press would give more prominence to these particular frauds, which have become very frequent of recent years, it would act as a

deterrent on others who undoubtedly are still carrying on similar operations.

In view of a long list of cases which the police were able to trace against the prisoners, extending over a period of years, the sentences passed may be considered very light, but the fact that the prisoners have been convicted, and the publicity given by the Press to the methods of the gang, will undoubtedly have a far-reaching effect, and be of the greatest interest to tramway companies and other concerns where accidents are constantly happening in connection with their undertakings.

Torquay Tramways Arbitration.

Mr. Archibald Reid, an arbitrator appointed by the Board of Trade, commenced an inquiry at the Surveyors' Institute, Westminster, on Monday, to determine whether the Torquay Corporation had wrongfully withheld their consent to the construction by the Torquay Tramway Co. of the overhead trolley system on lines 5 and 5A of the service. Mr. Vesey Knox, K.C., appeared for the company, and Mr. H. Lloyd for the Corporation.

Mr. Lloyd immediately raised the question of the right of the Board of Trade to appoint an arbitrator at all. Mr. Reid, he said, had been appointed under Sec. 68 of the Company's Tramway Act of 1904, which had general application to cases of dispute. The lines in question, he contended, came under Sec. 58 of the Act, and disputes over this were specially provided for in sub-Sec. 15, which did not contemplate compulsory arbitration. The Corporation claimed the absolute veto over these lines. He asked that this point be decided before the arbitration proceeded.

Mr. Knox submitted that Sec. 61 applied to all previous sections. He pointed out that notice of the company's application for arbitration was given on July 12th, but in spite of this the Corporation had taken no steps to represent to the Board of Trade that it had no power to appoint an arbitrator. It was most important that the matter should be proceeded with at once, because at the end of October the company would have to install another system if they meant to carry on the service, as the Board of Trade had refused to renew the Dolter surface-contact permit.

Mr. Lloyd pressed his objection and said the Corporation felt so strongly on the subject of overhead wires, that they would not have consented to a single inch of tramway being laid if they did not believe themselves to have retained absolute powers in the matter, not subject to compulsory arbitration. After further argument it was decided to proceed with the inquiry, the Arbitrator promising to state his view on the legal point raised so as to give the Corporation an opportunity to take the matter into Court if necessary.

Mr. Knox, for the company, then went into the history of the Torquay tramways. Their construction, he said, was the outcome of a postcard poll of the population, of whom a majority in 1892 decided that they wanted tramways, but did not want the Corporation to run them. In 1904 the Dolter Electrical Traction Co. obtained Parliamentary powers to construct tramways. There was no question of surface contact at that time, and the system was generally discredited on account of the cost and trouble and the difficulty of getting a uniform service. Unfortunately, the Dolter people thought they had found the key to these problems in 1904, because a small piece of line in Paris worked well under favourable circumstances, and the Dolter surface-contact system was installed at Torquay. About 11 miles of line in all were constructed, including the greater part of line 5, but line 5A was not constructed yet. The Board of Trade had refused to grant the company power to use the Dolter system after the end of October next, and when the company, therefore, applied to the Council for leave to put up the trolley system, permission was refused. These proceedings were brought to show that the consent of the Corporation had been unreasonably withheld. He would ask the Arbitrator to notice that the Corporation had power to acquire the undertaking at the end of 1914 on a valuation of the business as a going concern, and with nothing for compulsory purchase, and as the company would not have any profit at all unless it got the powers it required, he suggested the Corporation had interests besides purely æsthetic ones in the matter. Proceeding, counsel pointed out that there were four ways of propelling tramcars, but the overhead system was the most general. It was in use on over 20,000 miles of American tramways, and the only fault that could be found with it was that the posts were ugly and inconvenient. The only other system in use was the conduit system, which was very expensive. The Lorain system of surface contact and the G.B. system were little used, and they knew that the Board of Trade had refused to sanction the latter system for Torquay. He believed that the Corporation were going to suggest that the Dolter surface-contact system plus the Mitchell studs gave perfectly satisfactory results. This gentleman, Mr. Mitchell, was a very ingenious engineer, and he had made a number of experiments for perfecting the working of the Dolter surface-contact system, but he (counsel) thought he would be able to show that no financier of any responsibility would put any money into a surface-contact system of tramways nowadays. This was a matter of importance to the company, because they would have to raise money to complete the construction of their system. Proceeding, counsel explained that the National Electrical Construction Co. acted as sole contractors to the Dolter Co. for laying down the Dolter system in the United Kingdom. They laid the system down at Mexborough, at Hastings, and at Torquay. Mr. Mitchell was at that time engineer of the National Co., but he afterwards became engineer to the Dolter Co. Mr. Mitchell had invented five forms of stud, and the company had tried all five, and failed with them all. On the Mexborough system £12,000 was spent in remedying the first defects of the surface-contact system, and in March, 1908, when the system had been at work less than a year, the overhead trolley had to be installed, with satisfactory results. At Hastings the Dolter system was used under favourable conditions for 2 miles of the front, but it cost double as much to maintain as the rest of the line. At Torquay, as in Mexborough, they had gone to a very great expense to get the Dolter system to work, and had spent £13,000 in purely experimental work. The Board of Trade gave them a provisional licence for six months, and was continually pointing out that the returns of defective studs showed that the system was unsatisfactory. On December 28th, 1908, the Board wrote renewing the order for another six months, but pointing out that there had been no improvement in the returns as to the defective studs. Finally, on October 13th last, the Board wrote stating that they could not renew the order after October 31st of this year. The matter was put before the Torquay Corporation, and the discussion that followed on it, and the letters sent to the company, were privileged; but evidently the Council wanted too much in return for their consent to the overhead system on these two lines. As far as the other parts of the system were concerned, the company had power to use the overhead system there, and the Board of Trade had approved the plans submitted. Counsel proceeded to explain, with the aid of a Dolter box and studs as at present used at Torquay, the difficulties of this system. He explained that the sea water got into the boxes and interfered with the working. A special oil was used to keep out the water, but the oil carbonised after a time. It was thought that this difficulty might be got over by frequently changing the oil in the boxes, but it was impracticable to do so because of the construction of the boxes. If they were meddled with they got worse. As to the Lorain system, this was similar to the Dolter, only bigger studs were used which projected higher above the road, and made the system dangerous. Mr. Mordey, the expert engineer, who would be called in support of the Corporation, had presented a long report on the matter purporting to show how all these difficulties could be overcome, but however excellent these suggestions might be theoretically, they would probably fail in practice. Counsel read parts of Mr. Mordey's report, and said that although the company had employed 37 men on the track daily to keep the studs right, they had not been able to get satisfactory results. He briefly referred to the scrapping of the stud system on the Mile End route by the London County Council, in spite of a hopeful report by Mr. Mordey as to how it could be improved. In conclusion, he said that in 1908 the gross earnings of the company were £15,055, and the net profit £3,183; in 1909 the gross earnings were £15,445 and the net profit £2,426. It would thus be seen that nearly the whole earnings went in the maintenance of this expensive system, and in a little while there would be no profit at all, which was, perhaps, what the Corporation wanted.

Mr. William B. Cownie, one of the directors of the tramway company and the general manager and secretary of the National Electrical Construction Co., Ltd., gave evidence as to the installation of the Dolter system at Torquay and elsewhere. At Mexborough the company spent £10,000 in trying to improve the system on the lines of experiments suggested by Mr. Mitchell. In March, 1908, in consequence of pressure by the Board of Trade and local authorities, they had to put in the overhead trolley system. At Torquay the company had spent £10,491 in an attempt to improve the Dolter system. This outlay represented purely experimental work, and they were now as badly off as before. The position as regarded the surface-contact system was hopeless. The tramway company had recently written to the Board of Trade asking if they would sanction the G.B. or the Lorain system at Torquay, and in a letter dated the 10th inst. the Board of Trade had refused to express an opinion on this matter as the systems had not been sufficiently tested. The experiments at Hastings to improve the stud system had cost the company £1,600. In all, in Mexborough, Hastings and Torquay they had spent £22,300 in about two years in experimental work, and they did not feel inclined to spend any more. At Lincoln there was about three miles of G.B. system, and at Wolverhampton there was the Lorain system. The latter system was, he believed, working satisfactorily, but no one would put any money into it if it were satisfactory.

The Arbitrator: Why not?

Witness: Nobody has any faith in surface-contact systems.

Proceeding, Witness said it was difficult to get any evidence of facts as to the working of the Lorain system. No one seemed to speak well of it, and it was not good enough for America. It had been working in England for six years, but was never heard of except in the locality in which it was used. Witness mentioned further that the Lorain people had refused to install their system for the Dolter Co. under a guarantee as to its working. He did not want to say what had occurred between his company and the Torquay Council as a matter of privilege, but he had been quite willing to pull up the Torbay Road line (one of the disputed routes), and leave it altogether, and to install the overhead system on the remaining portion, but the Corporation would not agree to this. Bournemouth had a conduit system in certain parts of the town, and the overhead system elsewhere, because they did not like the overhead wires and the posts, but the Corporation engineer was now recommending the Council to pull the conduit system up and install the overhead trolley everywhere. There was another difficulty in regard to the system at Torquay. The insurance company had been reluctant to renew the company's insurance, because up to March, 1909, they had had to pay £366 for horses killed by the studs, and claims to the amount of £136 were pending. Witness caused some laughter by remarking that when the studs were first introduced a donkey was killed, and its driver came running to the tram conductor and said it had had a fit. Now drivers were wiser and came on the company for compensation.

The Corporation charge for electricity, continued witness, was on a sliding scale, 2d. per unit for the first 50,000 and so on, and the company used 2·3 units per car-mile.

At this point the inquiry was adjourned until the following day.

On resumption on Tuesday, Mr. Cownie was cross-examined by Mr. Lloyd, who, in support of his legal argument of the previous day, put in an agreement between the Dolter Co. and the Corporation, dated January 14th, 1904, to show that the consent of the Corporation to the tramways was obtained on the understanding that no overhead system should be introduced on lines 5 and 5a. There was no stipulation for compulsory arbitration, and this was the agreement (said Mr. Lloyd), covered by Sec. 58 of the Company's Tramway Act of 1904, which he suggested made the present arbitration illegal. Witness said the Corporation had made no official complaint as to the working of the line, nor was he aware of complaints by the public. He had received complaints about the system from friends who had visited Torquay.

The Arbitrator: As a board the directors have never had to officially consider a complaint?

Witness: That is so.

Continuing, Witness said he came to the conclusion about 15 months ago that the Dolter system was doomed. Questioned as to the value of the Torbay route, witness said it just about covered expenses in connection with the Paignton extension. It was not a valuable line in itself, but it was vital to the Paignton extension.

Mr. Lloyd pointed out that the Paignton extension was made after witness had come to the conclusion that the Dolter system was doomed.

Witness replied that the board of directors (who were as well aware of the facts as himself) decided to proceed with the extension. As to witness's statement the previous day that he would be agreeable to pull up the Torbay route, that was his opinion at a time when he was not aware the company could install the overhead system on other routes without the Council's consent, as they had now been advised they could do.

Mr. Lloyd: You may have been advised, but the Corporation will have something to say about that.

In further cross-examination, Mr. Cownie said that, but for the prohibition of the Board of Trade, the company would have continued with the Dolter system; they would have been forced to do so. Parliament had refused an application by the Dolter Co. to install the overhead system in Folkestone, even if they paid the Corporation £30,000 in hard cash. The circumstances in Folkestone, however, were quite different. Witness refused to answer a question as to whether his company had tried to get permission for the overhead system in Oxford. Questioned as to the G.B. system at Lincoln, witness said he believed there were defects in it owing to live studs. His company would be prepared to put down the Lorain system if that company would give a guarantee of proper working for several years after construction. It would cost £2,600 a mile to put the Lorain system in Torquay; this was the Lorain Co.'s quotation for an installation at Folkestone. The total cost of installing the Lorain system over the Torbay route at Torquay would be about £6,000, while the overhead system could be installed for £1,000. Questioned as to Mr. Mitchell's new stud, witness said his company had not considered it; they had had enough experiments. The conduit system, continued witness, was impossible in a hilly place like Torquay.

Mr. Lloyd: So that it comes to this, there is only the Dolter, the Lorain and the overhead, and you say you will have the overhead or nothing?—Witness: Yes. He added that, commercially, the overhead system was the only one under which any responsible contractor in the country would give a guarantee.

Re-examined by Mr. Vesey Knox, Witness said the proposition by the Corporation that the company should abandon the Torbay route (No. 5) and construct route 4, would mean that they would have to abandon the £12,000 capital spent on the Torbay line, and spend £8,000 more on constructing the new route, which was not a popular one with the public.

Mr. Knox: Did you, in fact, make an offer to the Corporation to abandon the line in Torbay Road and put the overhead system on back routes?

Witness: No, but it was recommended to the directors. The installation of the Lorain system, said Witness, would mean the reconstruction of the line.

The Arbitrator: If you have made a bad bargain, is it unreasonable of the other side to hold you to it?

Witness said a bargain of this sort was to an extent experimental; anyway, the company could not possibly carry it out. They had the money promised for a conversion of the tramways to the overhead system, but nobody would finance them if they had to reconstruct a surface-contact system.

Mr. James Swinburne, consulting engineer in electrical matters, said there were an enormous number of surface-contact systems invented, but in his view none have proved a success. The overhead trolley had practically "swept the board." It could not be said that the stud system had proved satisfactory, although it was quite possible to get evidence in its favour from men who were satisfied with it in particular places—especially if they were running it themselves. In his opinion the Dolter system was a decided failure. There were special reasons for the failure of the system in Torquay, because the roads were often covered with water, and, he believed, were sprinkled with salt water to keep them moist in summer. There the road had not a good foundation. Witness went on to explain how the water got into the stud boxes, which, he said, was always something of a mystery. Witness was of opinion that it was not fair to ask the company to attempt improvements of the present stud system. If they adopted the Lorain scheme, for instance, they might improve the system, but the improvement would be very slight. He saw no reason why the trolley system should not be used in the Torbay Road.

Cross-examined, Witness said his objections to the Lorain system being installed at Torquay were that it would be very expensive, and that the system had not been sufficiently tested. There would also be the trouble of dealing with the two systems in one place. Lorain had not made its way in the tramway world at all, and it should have forced its way to the front in eight years' working if it was a good system.

Re-examined by Mr. Knox, Witness said he had seen Mr. Mordey's report, which seemed to be chiefly devoted to showing that the Dolter system could be improved by using one pot instead of two for the studs.

Mr. J. F. Primaresi, engineer to the National Electric Construction Co., gave evidence as to the mode of working the Dolter system. One of the great difficulties was to get an oil for the pots which was heavier than sea water, so as to keep the latter out. It was difficult to get a satisfactory oil, as the heavy oils contained acids that attacked the metal parts and could not be used. They had also recently discovered that the bitumen parts had been attacked in the course of two or three years, although they had given a guarantee that the oil did not harm bitumen. Questioned as to the change from the Dolter to the overhead system at Mexboro, witness said the former system required 2·3 units per car-mile, and the overhead 1·7 units per car-mile, with the same car over exactly the same route. The cost for maintenance and electric equipment was ·106d. per car-mile for the overhead, as compared with 2·5d. for the Dolter, and the takings, since the change to the overhead system, had risen from 7·5d. per mile to 10·07d. per mile, possibly because the service was more regular.

Cross-examined by Mr. Lloyd, Witness said the company had got the most satisfactory thick oil possible. They were satisfied it was heavier than sea water, but it would in time affect the bitumen parts. This thick oil could not be used in the inner pot where the stud lever was, as it would retard its working. This would present a difficulty in the use of a single pot as suggested by Mr. Mitchell and Mr. Mordey. The number of studs affected by water, or oil carbonising, in 1908, was 158, and the number was an increasing one. They got more water in the pots than they used to, showing that the system got worse in use.

Mr. John B. Braithwaite, of the firm of Foster & Braithwaite, stockbrokers of Austin Friars, said his firm had had considerable experience of finding capital for tramways. They had financed the Bombay Electric Tramways, the British Electric Traction Co., the Metropolitan Electric Tramways, the Potteries Electric Traction Co., and the South Metropolitan Electric Tramway and Lighting Co., representing a total capital of £9,399,000. Witness considered it would be quite impossible to raise money for the construction of a tramway on the Dolter system, because experience so far was that any surface-contact system was far from perfect.

Mr. Holliday, the manager of the Torquay Tramway Co. since 1907, said they had tried three different types of studs invented by Mr. Mitchell. The wages bill for nine months in March, 1907, was £1,417 for men patrolling the line to look after the studs. Now this work was left to the car conductors on the journeys. There was a large leakage of current with the system. The records for a week taken in the present month showed 1·94 units per car-mile registered on the car, and 2·20 units registered at the station, so that there was a quarter of a unit lost to every car-mile, the proportion being greater on wet days than fine. This leakage represented a loss of £679 a year. The sea water flooding the line caused the service to be suspended four or five days each year. The repairs to electrical equipment averaged ·41d. per car-mile in 1908, ·55d. in 1909, and ·51d. for the first six months in 1910.

Cross-examined by Mr. Lloyd, Witness said they now only employed three men to remove dead studs. This would mean that many dead studs would be left on the line, and would throw a slightly greater strain on the working ones left, and so produce quicker carbonisation of the oil. Witness believed that on the overhead system the leakage of current was not more than one-tenth of a unit per track-mile.

The proceedings were adjourned until Wednesday.

Theft of Electrical Goods.

At Marlborough Street, on September 1st, Rueben Holdaway, 28, counter assistant, North Holme, Atterbury Road, Harringay; and Robert Pearson Mills, 19, counter assistant, Ellerdale Road Lewisham, were charged before Mr. Denman with stealing since June 1st last electric lamps, &c., value £12, the property of their employers, the General Electric Co., Ltd., Queen Victoria Street, E.C.; and James Alexander, alias Steely, 32, electrician, Swallow Street, Piccadilly; George Phillips, 39, electrician, Keeton's Road, Bermondsey; and Walter Little, 49, porter, Goodge Street, Tottenham Court Road, were charged with receiving the property in question at Swallow Street, well knowing it to have been stolen. According to the evidence (as reported in the *Morning Post*) of Detective-sergeant Prothero, it appeared that, in company with Detective-sergeant Vanner, he watched the Swallow Street premises, and saw Alexander, Little and Phillips dealing with parcels, which they took down to a basement they occupied. The officers followed them down, and the men were arrested after one of them had confessed that the goods were stolen. The parcels were found to contain goods which belonged to the General Electric Co. The other prisoners were apprehended in consequence of what was said at the premises of the prosecuting firm.

Detective-Sergeant Vanner deposed that, in company with Sergeant Prothero, he went to the premises of the company, where he saw Holdaway and Mills. The former said he had given Phillips 50 or 60 lamps a week for the past ten weeks or so. Sometimes Little came up for them. The arc lamp was given to him by Mills, who asked him to hand it over with other things. When Mills was interviewed he said he had been induced by Alexander to obtain an electric fan.

Mr. J. J. Fletcher, manager of the company, identified some of the stolen property. He desired, on behalf of the company, to recommend Mills to the lenient consideration of the Court.

Mr. Lunge said the company wished to thank the police officers for the vigilance they had displayed in the matter.

Mr. Denman said a systematic method of stealing and receiving appeared to have been carried on by the prisoners. Holdaway would be sentenced to three months' imprisonment, Alexander to six months, and Phillips and Little to four months' hard labour each. Mills, whose case was not as bad as the others, would be placed under the Probation Act for three years.

Disputed Account.

Judgment has been pronounced in an action brought before Sheriff-substitute Smith Clerk, at Glasgow Sheriff Court, at the instance of Messrs. T. Fairlie & Co., electrical engineers, 38, Stockwell Street, Glasgow, against the West of Scotland Billiards Co., Ltd., 75, Argyle Street, Glasgow. Payment was sought of an account for the putting in of new and the rearrangement of other electrical fittings in defenders' premises, the amount sued for being £92.

The defenders, while admitting that pursuers were instructed as to the work, objected to certain charges in respect that they had not been incurred at their instructions, that no credit had been allowed for goods returned, and that the pursuers had contracted to supply certain items at prices less than those charged. Payment was tendered for £61.

The Sheriff in a note, says :—"I formed the opinion in the course of the proof that these objections to the account had no solid foundation, and later perusal of the evidence confirms this opinion." He finds that the prices charged were reasonable and proper, and held defenders liable in payment for the account, less £4 1s. 6d. of returns, and gave decree accordingly, with expenses.

BRUSSELS EXHIBITION.

(Continued from page 294.)

The firm of "Electrotechnische Industrie," formerly Willem Smit & Co., of Slikkerveer, Holland, have a representative exhibit in the Machinery Hall, from which we have selected a few items for illustration. The largest machine shown is the stator of a three-phase alternator of 625 k.v.a. at 125 r.p.m., with its exciter, and the wound stator of a three-phase turbo-alternator of the same output, but running at 3,000 r.p.m., is also an interesting feature of the exhibit. The latter is well provided with ventilating ducts, the casing being completely closed and fitted with apertures for the controlled admission and discharge of air, and the end windings are strongly supported against deformation with the aid of wooden blocks and stout screws holding the winding tightly against the carcass.

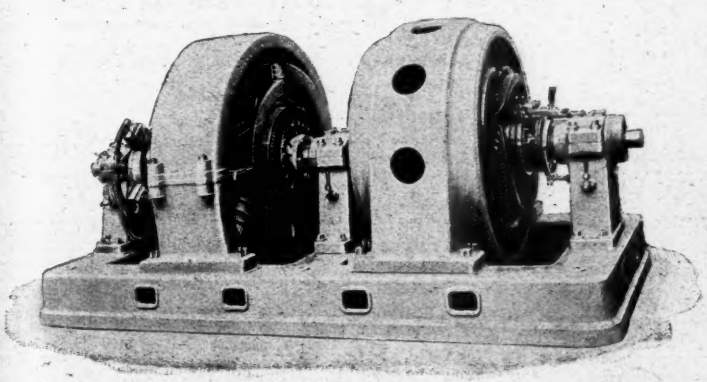

Fig. 26.—Motor-Converter of 300 kw. by "Electrotechnische Industrie."

We illustrate in fig. 26 a motor-converter for 300 kw., receiving three-phase current at 6,200 volts, and generating direct current at 650 to 750 volts, when running at 750 r.p.m. This set is furnished with three bearings, the connections between the d.c. and a.c. armatures being carried through a hollow shaft, but in later designs the makers prefer the two-bearing type. The rotor of the induction motor is provided with three slip-rings for starting, and with a 12-phase star-connected winding, which can be short-circuited by means of a hand-lever whilst running. The direct-current generator is provided with a damping device of copper on the pole shoes to damp out any pulsations that might be set up. The machine works sparklessly on full load and at 750 volts, at which pressure the three-phase side supplies a wattless current of 18 amperes to the supply mains—an arrangement devised to compensate the power factor of motors on the mains. A d.c. generator of 350 kw. at 215 r.p.m., driven by a Diesel engine, is shown on another stand, and a steam dynamo destined for use on a torpedo-boat is exhibited.

The latter, which has an output of 110 amperes at 110 volts, 550 r.p.m., is illustrated herewith. It is of very light construction, the dynamo parts being largely of brass, and the bed-plate of girders, while the armature is fixed direct on the fly-wheel, with a tubular inserted shaft running in the outer bearing. The other figures show respectively an induction motor of 220 h.p. at 1,460 r.p.m., and one of 65 h.p. at 2,900 r.p.m.; the former is provided with a short-circuiting device of spring-rings inside the slip-rings, and the latter has a squirrel-cage rotor, with very long bearings and special devices to prevent the escape of oil. Many other machines are also shown by this firm.

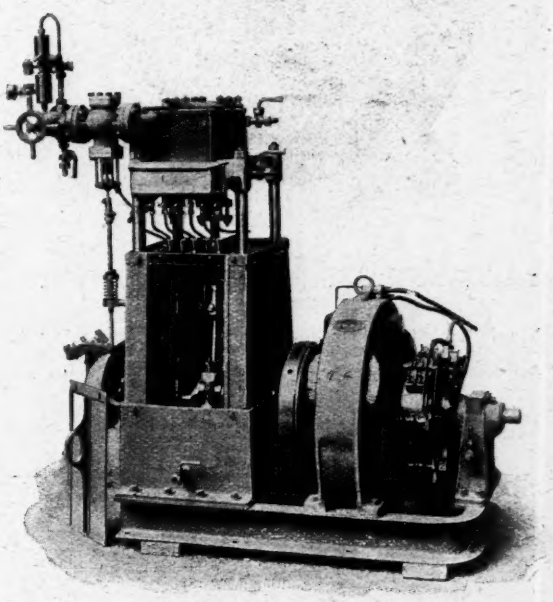

Fig. 27.—Steam-Dynamo for Torpedo Boat (Elec. Ind.).

A remarkably large "Locomobile" plant is exhibited by Messrs. R. Wolf, of Magdeburg-Buckau, and 7, Laurence Pountney Hill E.C.; it consists of a 650-b.h.p. engine and boiler driving two 200-kw. generators, and supplying part of the electric power to the Exhibition. The construction of the locomobile is shown in fig. 31; it combines in one a complete steam-power plant, comprising a boiler, with removable furnace and tubes, superheaters, jet condenser, feed-water heater, air and feed pumps, with a compound engine mounted on the top of the boiler. Only light foundations and no brick setting are required for the boiler, which is designed for a working pressure of 215 lb. per sq. inch. The main superheater consists of coils of steel tubing immediately behind the fire

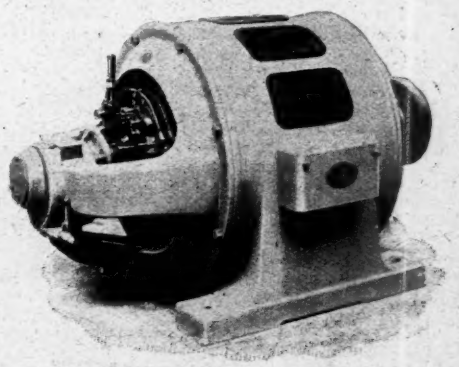

Fig. 28.—Three-Phase Motor of 200 h.p. (Elec. Ind.).

tubes, through which the steam passes in the opposite direction to the gases, and there is a second superheater behind it, in which the exhaust steam from the high-pressure cylinder is reheated before it enters the low-pressure cylinder. The engine cranks are set at

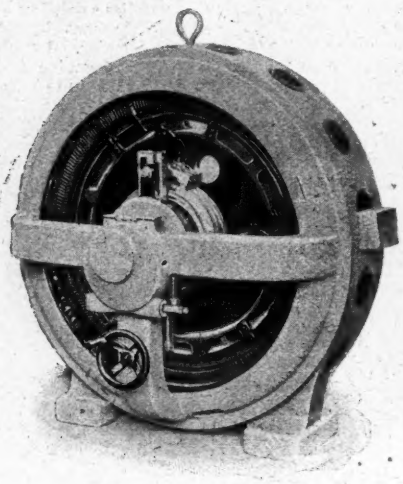

Fig. 29.—Three-Phase Motor of 65 h.p. (Elec. Ind.).

180°, and the cylinders are directly connected to the crank-shaft bearings by a substantial frame, which prevents the transmission of the working stresses to the boiler shell. The cylinders are jacketed by the waste gases. The valves are of the balanced-piston type, and the shaft governor acts directly on the high-pressure eccentric, providing automatic variable expansion. The furnace is fitted with a mechanical stoker of the sprinkler type. The makers claim for this engine a consumption of only 1·03 lb. coal and 8·8 lb. steam per B.H.P. per hour. In the Machinery Hall they show locomobiles of smaller size, and other machinery, and they state that more than 4,000 of their superheated steam plants are in use for electric power generation and other purposes.

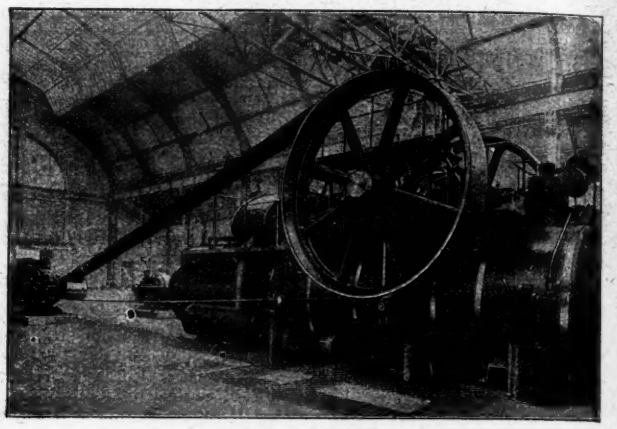

Fig. 30.—Wolf Locomobile of 650 B.H.P.

The last illustration shows an interesting relic of the fire; it represents the exhibit of the British Vacuum Cleaner Co., Ltd., after the catastrophe. The electric motor can be seen under the two tanks. This exhibit was almost the only one, we believe, that retained a recognisable shape.

(To be continued.)

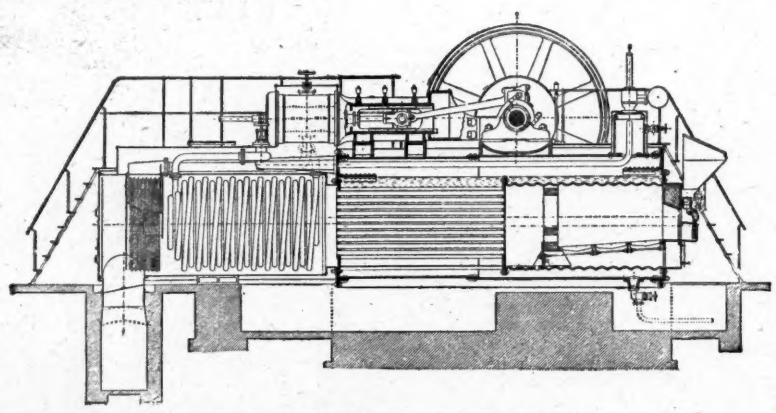

Fig. 31.—Section of Locomobile.

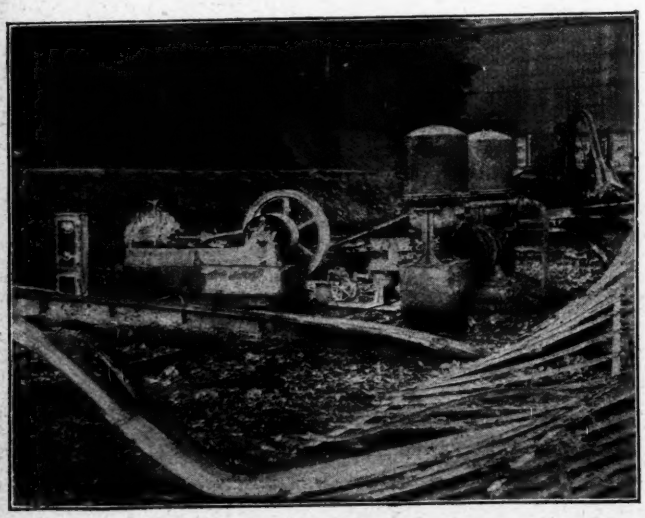

Fig. 32.—The British Vacuum Cleaner Co.'s Exhibit after the Fire.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Tramway Meters.

In the ordinary course of events the use of meters or time recorders on electric tramcars involves a considerable risk of damage to the equipment.

It is now recognised that short of slipping the wheels a car is accelerated with the least expenditure of energy by turning the controller handle as fast as possible. This, therefore, necessarily strains and overheats the motors. The same applies, but with greater force, to the use of time meters.

In order to be able to make use of the above devices for saving energy, it is absolutely essential to adopt some means of preventing the motormen from abusing the controller. This object is attained by the use of the now well-known patent controller regulator, which compels the driver to make a short pause on every step of the controller, thus ensuring correct acceleration without in any way interfering with the free action of the motormen. A number of important tramway systems both in England and abroad, have adopted this device, and have by this means succeeded in considerably reducing the cost of repairs.

The Electrical Apparatus Co., Ltd.

London, S.W., *September 6th*, 1910.

British Westinghouse Electric Co. v. Ridings Arc Lamp Co.

In the "Legal Column" of the Electrical Review of September 2nd you gave particulars of an action between the British Westinghouse Co. and ourselves in connection with arc lamps.

As this notice is very misleading to the public, and damaging to us in our business as arc lamp manufacturers, we should be glad if you would insert a note to the effect that this action related to the importing into this country by us of 140 Excello arc lamps only, and had nothing whatever to do with the lamps we manufacture ourselves under Ridings patents.

To prove the correctness of our statement we enclose copy of affidavit filed by the British Westinghouse Co. in this action.

Ridings Arc Lamp Co.

Manchester, *September 8th*, 1910.

Coal-Cutting Machinery and Electrical Accidents in Mines.

On page 324 of your issue of August 26th you remark with reference to the much-discussed question of efficient "earthing" of colliery installations, that the only correct and certain way is to lay a bare copper earth wire and connect every part that requires to be "earthed" directly to it and carry this right up the shaft to a large earth plate properly bedded on the surface.

Why a *bare* copper earth wire?

In the not unlikely event of the earth wire becoming accidently disconnected or broken in the vicinity of the earth plate, does not the presence of the bare copper wire in the mine only tend to increase the danger which it was erected to obviate?

Would not an earth wire *perfectly insulated* throughout its entire length answer the purpose better?

Austin Burdon.

Evening Classes: Wanted—A System.

I should like, through the medium of your columns, to say a few words on the subject of the evening classes of the present time. I have read with considerable pleasure Prof. Hobson's remarks upon the subject in his address, published in your issue of September 2nd, on the subject of mathematics. The professor concludes by saying that students should be taught a few things well, and not a number of things imperfectly. What we want (and I speak as a student of seven years' experience) is a system, for as things are at present, absolutely no system prevails. A student takes, let us say, a group course, which consists of three attendances per week, one evening machine drawing, one mechanics, and one mathematics. With the first we are not concerned here, but to my mind the second and third should go hand-in-hand, so to speak. The method of teaching mathematics nowadays is deplorable. The majority of the students in their first year have, when they start, a knowledge of addition and subtraction, and that is about all. The classes commence, in many cases, with contracted methods of multiplication and division, and various so-called short cuts of that nature. The student, after an hour or two of this, is so utterly confused that he cannot even do the calculation correctly in the usual way, and is hopelessly at sea with the other methods. The following week some other portion of the work is started on, and this goes on throughout the session, so that, at the finish, the student is little wiser than he was at first. The fault, to my mind, is not so much with the instructors as with the education authorities; the amount that is required of the student in some of the earlier stages of mathematics is enormous, and it is next to impossible for the class of student I refer to, to get the necessary knowledge in the time, which amounts to, usually, about 30 classes, each of two or three hours' duration. This means that the instructor has only got time to go over the bare outline of the subject, and that the student who wishes to know what he is doing, has to spend many hours in trying to understand his scanty notes, and the two or three examples given him. The final result is that he gives up, in many cases, and lets the "beastly stuff" slide. I have heard students say at the end of a class, "What has he been talking about?" Then, on the question of logarithms: I have yet to find the student who has learnt them, without any previous knowledge, at the night school, learnt them, that is to say, so that he could save any appreciable time in working out even simple problems by their aid. Then, again, how many masters thoroughly understand the slide rule themselves, let alone being able to teach it to the students? Why, a student who can work out a simple problem, with the aid of a slide rule, in one minute less than any of the others can do it in by ordinary methods, is looked upon by his fellows as a positive marvel.

I said just now that a system was required; what I meant was this: Students take classes year after year and pass sundry examinations at the end of each session. This is all very well in its way, but what does it lead to? Employers of to-day do not recognise the certificates thus gained. What I call a system is practised in a certain town in the Midlands. If the student takes certain prescribed evening classes for five years, passing through certain examinations at the end of each year (that he may be proved fitting to advance in his studies), he will be in a position at the end of that period to enter, with the certainty of passing, for the examination of A.M.I.C.E. That is what I call system; for the student, who really wants to get on, knows there is something at the end of it all that is worth having. Another point which should be looked to is that all home work and worked-out examples should be duly entered up in a book kept specially for that purpose, and regularly and carefully checked over and marked accordingly. As an illustration, I might mention the case of a student I came into contact with who did a test one evening on a two-phase induction motor. He worked out his results later, and found that for every horse-power put into the machine he got 1¼ H.P. out of it. Those results were worked with the slide rule, by logarithms and by ordinary and contracted methods, and the result came exactly the same in each case. The results were duly entered up, and given in for correction. The book was returned next week, *with all the work marked correct*. Comment is needless. Small wonder that students lose all interest in their work, and give up in disgust. For myself, I have taken to correspondence instruction; and though I have been at it continuously for 15 months, I have never had cause to complain or to regret taking it up. Should this catch the eye of the student who tested that motor, perhaps he will come forward and second what I say.

Adsum.

September 12th, 1910.

The Lighting of London.

A most misleading impression has recently been created by certain paragraphs appearing in the Press under the above heading. The impression given was that London, instead of continuing an electrically-lighted city, as at present, was about to revert to gas.

I need hardly say that nothing is further from the truth. The case, however, presents an interesting example of how easily an erroneous impression can be set afloat. The facts are as follows:—

One of the 29 London authorities, influenced by conditions which were purely local, decided to alter a few of their numerous electric lamps to gas lighting. The number of the lamps involved is quite small compared with the total number of lamps in the borough in question, and is altogether negligible in comparison with the total electric lighting of London. The whole case, in fact, is simply a local matter, confined to one authority only, and is quite undeserving of this wide publicity, were it not for these incorrect rumours which have given rise to so much misunderstanding.

For corroboration of the facts, reference need only be made to the official statistics of the London County Council, where it will be seen that the use of electric street lighting has more than doubled in half-a-dozen years, and that only 10 out of the 29 London authorities are wholly without electric street lighting.

As to the relative costs of electricity *versus* gas for street lighting, I need only mention that in St. Marylebone the

saving effected last year was £1,500 in respect of a portion of their area only, and that this has encouraged them to convert the whole of the remaining gas lamps to electric light, which will bring the saving up to £2,600 per annum.

Further, the Boroughs of Hampstead and Shoreditch—already extensively electrically lighted—are extending electric lamps practically throughout the whole of their areas.

Thanking you for your courtesy in giving publicity to these facts,

H. B. Renwick,
Chairman of the Electric Supply Publicity Committee.

London, E.C., *September 12th*, 1910.

Overcrowding in the Ranks of Central Station Officials.

I cannot let the correspondence in reference to the above pass without joining in it myself. With my fellow correspondents I quite agree that a central station is not the place for premium pupils, except, of course, from the financial point of view of the chief.

As regards an association for assistants, has it not a flavour of a Bricklayers' Union with its allied lock-outs and disputes? I think a better state of affairs would exist if chief engineers would show their assistants that they (who should desire to keep up the status of the profession) are willing to pay salaries equal at least to those paid to wiremen and stokers. Further than this, I would suggest that chief engineers in this case would want better men than there are, in many cases, employed as switchboard attendants. Then, again, from 10 years' practical experience of central station work, I cannot help coming to the conclusion that the chief likes to keep his wages sheet at the lowest possible figure, so that he may point with pride at his low cost of production.

As an assistant who *has* been through the "shops" and received his technical education at one of the best sources in the country, I should be only too pleased to help in the formation of any association if it would meet the case.

In conclusion, let me add that should such an association be formed, "Justice" hits the right nail on the head when he suggests that the association should supply to assistants information concerning the chief engineer before they take office under him. But again, beggars cannot be choosers.

C.

The Proposed Association of Consulting Engineers.

Observing Mr. Curry's rather shifty debate on this subject, I thought it opportune to cheer him in his somewhat crest-fallen dilemma and encourage him further for the last lap of defence for the standing of his little fetish.

So far as I can recollect the articles of the proposed association, without actually taking the trouble to re-read the discussion, &c., it appears to me that the points under discussion are the qualifications necessary for membership. Was it not stipulated that consulting engineers could only qualify for membership if they had at least three years' practice on their own account and also belonged to the *invincible* "*Civils*" and the Institution representing the other branch they specialised in? It was also argued that "civil engineering" meant "engineering," irrespective of the adjective.

Now, it has been conclusively proved and frankly acknowledged that "civil engineering" merely represents a branch of the all-embracing heading "engineering." Moreover, Mr. Curry reverses his opinion now, and actually admits that experienced consultants should have precedence to I.C.E. qualifications, which formerly formed the essential qualification to his mind.

Might I ask him casually how many corporate members of the I.C.E. obtained membership through examination, and why these would have preference in the new body proposed; also why equally qualified University men to those University men who obtained membership without further examination than their degree should not be held on the same standing, simply because they do not join the "Civils"? There are hundreds of degree men in engineering who have also a very comprehensive works training and belong to at least one of the other Institutions representing branches of engineering, yet these poor fellows must join the "Civils" to be registered as qualified consultants. Isn't it absurd?

Let us take the instance of a lad intended for the consulting profession; say he receives a perfect preliminary education, subsequently a University training, and takes his degree or degrees, perhaps with honours, and at the age of 20 proceeds to a vigorous training for, say, three years in and on works; then joins a firm as a junior consultant, and in the course of another five years rightly expects to be regarded and registered as a qualified consultant. Poor fellow! he finds that I.C.E. members have made the law, and he must necessarily fork out the dole for election to their Institution. Is it not a pity our Universities could not get a little more standing?

Let me remind Mr. Curry that a degree is a very different thing to a diploma, and should be honoured accordingly. An engineering degree man does not usually go to practise as a consultant without a reliable practical experience, yet why should he be forced to contribute to any one institution more than another?

Let the organisers of the proposed Association take liberal views of qualifications, and general approval may be forthcoming.

The same game was attempted by the "patent agents," but before they got supreme powers they had to take a very liberal view, and incorporate all patent agents practising prior to the date of incorporation, and if our consulting friends intend protecting the business, I think they will find that the only satisfactory way will be to work up to the standard of attainment gradually, exactly as did the patent agents. It may take years, yet justice can only be achieved in that manner.

"Incorporate a man according to his record"—our able Editor gave a sound epitome on the tree of knowledge.

B.Sc., &c.

The Association of Mining Electrical Engineers.

Referring to your leading article of September 2nd, in which you state that the Association of Mining Electrical Engineers is too hopelessly in the hands of the colliery managers to be expected to do anything towards the question of examinations for electrical engineers in charge of mining plants, I beg to point out that arrangements for this object are being made, and a sub-committee was appointed at the last council meeting.

At the same time I may point out that practically very little could be done until we received our articles of incorporation, which may now be sent us any day.

The delay has not been the fault of the Association, but the red-tapeism of the Board of Trade.

As far as my personal experience goes, with the colliery manager members of the Association, the majority of them are strongly in favour of the examination, as it will prove very useful to them in many ways in selecting a man to take charge of the plant, and I am open to prove this at any time to those who think otherwise.

Perhaps the question of including mining engineers and officials does not appeal to you, but in the interests of the Association and the mining industry it has been found that the opinions of expert mining men and expert electrical men combined in the discussions will bring out most valuable information, and that is practically essential towards achieving the objects for which the Association of Mining Electrical Engineers has been formed.

A Council Member.

The Price of Electricity.

In the interesting comments you make upon my paper on the above subject, I think that you correctly diagnose the feeling of electrical engineers all over the country when you say that their recent utterances on this subject, and also their practice, show that the character of demand has begun to influence price. By "character of demand" you, no doubt, include what I have called "intensity of demand," a common expression amongst economists. Without finding any fault with your interpretation of this term,

perhaps you will allow me to explain the sense in which I have used it. All psychological factors lack precision, but if we regard "market price" as expressing "intensity of demand" in money measure, we arrive at a practical definition, which, neglecting academic subtleties, gives us, I think, all the explanation we want. Your expressions "the measurement of the wish" or the "vehemence of the desire" for anything do not, I think, quite cover the ground. The vehemence of our desire for air to breathe is perhaps infinite, but air has no price. There is an element missing. Intensity of demand is measured by the relative strength of our demand for that which we have to pay for, or, in other words, our relative effective demand as exhibited in the market. We thus come back to price in the market as the measure of it.

Your analysis of the "maximum demand" system seems to me to be entirely to the point. It is often "maximum demand" in name and a classified tariff in fact. There is, of course, nothing inconsistent with the system I advocate in the use of "maximum demand indicators."

Is there not considerable confusion of thought in the idea that early consumers, who paid relatively high prices, bore "the heat and burden of the day"? "Heat and burden" implies suffering, but I suspect that they obtained satisfaction, or they would not have paid the price.

I welcome your concluding sentence, in which you say that you think that we are "moving in the right direction," and I much appreciate your efforts to accelerate that movement. It may involve an expansion of our industry beyond our present powers of perception.

Edw. W. Cowan.

London, E.C., *September 10th*, 1910.

BUSINESS NOTES.

Accumulator Sediment Pump.—With a view to economising in the maintenance of storage batteries, the "Unica" sediment pump has been introduced on the market by Mr. S. Heilpern, of 82, Hamilton Road, Longsight, Manchester. It is claimed that it will lift the heaviest lead sediment

"Unica" Sediment Pump.

and foreign matter from the bottom of a cell without carrying away too much acid. The two sizes lift 5½ and 2½ gals. per minute respectively, at moderate speed. The pump is simple in construction, has no stuffing boxes or packings subject to wear, and can be dismantled in a few minutes; it is supplied with interchangeable suction nozzles for reaching below or between the plates.

The Constantinople Lighting Concession.—An extraordinary story is being circulated by various Hungarian newspapers with regard to the competition for the concession to establish electricity works in Constantinople. The story is to the effect that the negotiations between the Ganz Electricity Co. and the Turkish Government in respect of the matter have been broken off at the last moment. During the course of the negotiations, which took place at Budapest between representatives of the company and the members of a special Turkish Commission dispatched to that city, the Ganz Co., it is said, voluntarily withdrew from undertaking the work. In explanation of this surprising action, it is set forth that, under the treaties of commerce concluded with the Balkan States, the import duties on electrical machinery have been fixed so high that the Ganz Co. is unable to undertake the work on the basis of the unit price stipulated before the conclusion of the treaties of commerce. The story, which has been forwarded to a German newspaper by a Hungarian correspondent, sounds improbable, and, for that matter, it would be of interest to learn what new treaties of commerce have been completed in the past few months in the East of Europe, which could possibly have such an effect upon Hungarian exports to Turkey. Since writing the foregoing, the improbability of the story has been apparently confirmed by the further announcement from Budapest that there is agreement in news to the effect that the Ganz Co., besides the establishment of electric lighting in Constantinople, will be entrusted also with the erection of the gasworks to be built in that city.

British Trade in Finland.—The British Consul at Helsingfors reports that there can be no doubt that British interests in Finland would be served if there were a number of local agents representing British firms in various branches. It is not likely that possible Finnish buyers will take the trouble to consider seriously offers made only by post, without having any samples at hand; whereas a local agent, especially if he is an influential man, can do much by seeing the buyer in person and showing the article. Every British firm wishing to trade in Finland—and especially firms already trading with Russia—should, therefore, take steps to appoint an agent in one of the larger towns, preferably Helsingfors. British firms when wishing to appoint a local agent generally write to the Consul, asking him to suggest some suitable firm or person. The Consul then does so, giving a couple of names of respectable firms, either merchants or general agents.

British manufactures are held in high repute in Finland, and only the high prices frequently asked, as well as the energetic and skilful advertising of competitors, prevent their being more generally bought and used. In addition to other goods, machines, tools and implements could be exported in greater quantities than now; but it is possible that until the ground was properly prepared, the expenses would be heavy and the profits small.

As regards terms of payment, it will often be necessary to allow larger firms extended credit. It cannot be too often repeated that firms should quote prices preferably in the local currency—viz., Finnish marks and per kilogram or per metre, thus facilitating calculations for the Finnish buyers. The greater part of the trade with Finland is on a comparatively small scale, and much of it is done by three months' acceptances. Firms in the United Kingdom should not insist on payment against documents in the United Kingdom, but should adopt the more convenient method of payment against documents in Finland. It is chiefly owing to the unwillingness on the part of British firms to comply with requests by Finnish firms, founded on the peculiarities and traditions of local trade, that so much of the trade slips out of their hands and goes to foreigners more ready to see the local requirements and to meet them, thus firmly establishing themselves on the market and in the minds of local business men and the public.

A British commercial traveller recently wrote to the Consul as follows: "Before leaving Helsingfors I should like to thank you for the interest you have shown in my visit here, and the very valuable help and suggestions given, which I feel have not been given in vain. It is particularly galling to see foreigners all over Scandinavia selling their inferior articles while so much better goods can be made in the United Kingdom, and could be sold here with a little more energy on the part of our large manufacturers."

Inquiries as to the financial standing of various Finnish firms are often received at the Consulate. Firms wishing to obtain information in this respect should write to some local institution supplying such, *e.g.*, Finska Kreditgifvareföreningen (Finnish Trade Protection Society), Tammerfors, or Messrs. W. Schemmelpfeng, Gr. Schlossstrasse, Riga.

Catalogues and Lists.—The Benjamin Electric, Ltd., 1A, Rosebery Avenue, London, E.C.—Twelve-page catalogue (L2) containing illustrations and prices of Benjamin wireless clusters and electric lighting specialities.

The Sterling Telephone and Electric Co., Ltd., 200, Upper Thames Street, London, E.C.—Pamphlet No. 172, giving in the course of some 48 pages illustrations, descriptive notes and prices of a variety of the firm's well-known telephone instruments for various positions and different classes of service, also a number of accessories.

Messrs. Aland & Co., 203, Great Dover Street, London, S.E.—Twenty-four page illustrated pamphlet (No. 25) wherein are given particulars, illustrations and tabulated sizes, speeds, prices and code words of their electric and other fans, blowers and exhausters; also electric smithy blowers and small electric motors.

The A.E.G. Electric Co., Ltd., London, W.C.—Leaflet showing one of their portable drilling machines which drill up to 2 in. diameter for shipbuilding, tramway repair, and engineering works.

16-page list giving a number of excellent half-tone pictures prefaced by descriptive matter relating to, and particulars of advantages claimed for, the A.E.G. electric welding process. Butt and point welding are both well shown, and the pictures show the welders employed in different classes of work. We have also received a leaflet relating to transformer switch cases.

Messrs. Morris & Lister, Ltd., Carlton Works, Coventry.—New descriptive price list relating to their auto-transformers which they are supplying in considerable numbers. Special attention has been given to the point of silent working, and alterations in design have been made giving effect to improvements in this direction. Copies of the list can be obtained on application.

Messrs. Ernest Scott & Mountain, Ltd., Close Works, Gateshead-on-Tyne.—Twenty-four page catalogue containing a description, accompanied by half-tone illustrations and line diagrams, of the mechanical construction of the Scott & Mountain centrifugal pump. A few pages at the end contain hydraulic tables and formulæ.

The Union Electric Co., Ltd., Park Street, Southwark, London, S.E.—Sixteen-page new list (No. 1,019) containing a description, with tabulated prices, code-words, sizes, and so forth, of their direct-current motors for sizes ranging from ¼ to 50 H.P.

The Ecco Battery and Electrical Co., Invicta Works, Bow Common Lane, London, E.C.—Twelve-page pamphlet giving particulars and prices of a variety of "Ecco" dry cells, battery jars, pocket flash lamps, &c.

Messrs. Siemens Bros. & Co., Ltd., Caxton House, Westminster, S.W.—August, 1910, issue of their catalogue No. 37 (22 pages) relating to "Dry Cells and Dry Cell Batteries"; this list supersedes the April, 1910, issue. The contents have been rearranged, and the notes on the employment of dry cells for ignition purposes have been, to some extent, rewritten. New illustrations tions to scale are employed throughout. Also a new catalogue, No. 504 (eight pages), describing their "Optical Pyrometers." This list supersedes the November, 1907, price sheet bearing the same title. The principle and construction of the firm's optical pyrometer are described briefly, but the standard pattern on cast-iron stand has now been supplemented by a pattern with a wooden tripod stand, which is more convenient for carrying about. There is also now listed a portable pattern, all the parts of which may be carried about in a compact case with leather strap.

Mr. R. W. Paul, Newton Avenue Works, New Southgate, N.—New catalogue (section MI) dealing with thermo-electric pyrometers and indicators, which instruments have recently been re-designed, the use of a more powerful magnetic circuit having enabled the firm to use a longer pointer with a consequent gain in scale length.

Messrs. Simplex Conduits, Ltd., London, W.C.—Supplementary leaflet (F 1) showing a number of ship electric light fittings, and stating prices of same.

The Newall Engineering Co., Walthamstow, E.—New edition of their catalogue (64 pages) of Newall gauges, micrometers and measuring machines, all of which are well shown, described and priced. Engineers should find this catalogue of considerable service, and they can obtain copies on application.

Argentine Republic.—According to the *Board of Trade Journal*, a concession has been granted to Messrs. Paquet y Cia. for the construction and working of an overhead electric carrier, which will join the two banks of the Riachuelo River. The concessionaires have a six months' option to construct a similar overhead carrier, and also permission to import any material free of duty. Two years are allowed for the completion of the work.

Book Notices.—*American Street Railway Investments.* New York: The McGraw Publishing Co. $5.—The 1910 edition of this book has just been issued. It contains very elaborately detailed statistics and information concerning the financial and traffic results of operation of electric railways. It is the seventeenth annual addition of this work of reference, and contains more detailed figures of earnings, expenses and traffic that are of interest and value to holders of securities of these properties, than have been available for the previous issues. A compilation of the gross revenues of 10 large companies and of 20 smaller properties made in order to indicate how well urt an electric railways sustained their gross earning power after the panic of October, 1907, reveals interesting results. Gross earnings of the 10 large companies in 1809 showed a gain of 27·9 per cent. over 1905. The 20 smaller properties gained in gross revenue in 1909, as compared with 1905, 30·8 per cent. Supplementing the information in previous issues, the 1910 edition furnishes financial statements in greater detail, giving statistics that facilitate additional analysis of the actual results obtained.

"Log Book of Electric Light Installation." London: Hubert Russell, M.I.E.E. Price 30s. net.

"Continuous-Current Machine Design." By William Cramp. 1910. London: Harper & Bros. Price 5s. net.

"Faculty of Engineering, University College." Session 1910-1911. London: University College. Gratis.

"Atti della Associazione Elettrotecnica Italiana." Vol. XIV, No 4. 1910. Milan. Tipo-Lit. Rebeschini di Turati.

"Automatische Fernsprechsysteme." Two vols. By A. B. Smith and F. Aldendorff. 1910. Berlin: S. Heimann & Son.

"Traité de Physique." By E. Davaux. 1910. Paris: A. Hermann & Son. Price 11 fr.

"Charter, By-Laws and List of Members of the Iron and Steel Institute." July. 30th, 1910. London: The Offices of the Institute. Price 1s.

"Eléments de Calcul Vectoriel." By C. Burali-Forti & R. Marcolongo. 1910. Paris: A. Hermann & Son. Price 8 fr.

"*Bulletin* Scientifique de l'Association des Elèves des Ecoles Speciales." May-June, 1910. Liége: 23, Rue Agimont. Price 0·75 fr.

"Encyclopædia of Municipal and Sanitary Engineering." By W. H. Maxwell and J. T. Brown. 1910. London: Constable and Co., Ltd. Price 42s. net.

"The Empire Aspect of Preference." By Senator Pulsford, of Australia. 1910. London: The Cobden Club. Price 1d.

"Electric Lighting for Motor-Cars." By Marks & Clerk. 1910. London: The Technical Publishing Co. Price 3s. 6d. net.

"Design of Marine Multitubular Boilers." By J. D. Knight and A. W. Brown. London: The Technical Publishing Co. Price 3s. 6d. net.

"*Announcements*, 1910-1911." Northampton Polytechnic Institute. London: The Institute.

"*Journal* of the American Society of Mechanical Engineers." September, 1910. Baltimore, Ind.: The Offices of the Society. Price $1.

"*Journal* of the Franklin Institute." Vol. CLXX, No. 3. September, 1910. Philadelphia: The Institute. Price 50 c.

"The School of Mines Quarterly." Vol. XXXI, No. 3. April, 1910. New York: Columbia University. Price 50 c.

We have received a copy of a Guide to the Metropolitan Borough of St. Marylebone, which is published under the auspices of the Borough Council. On a number of pages we find particulars of the Council's aggressive electricity supply department, also pictures of the station and of the electric lighting of Oxford Street

Trade Announcements.—Messrs. Manzel Bros. and Co., of Buffalo, N.Y., announce that the term of their oil pump agency for Great Britain and Ireland, which has been in the hands of Messrs. Rimington Bros., of Carlisle, having expired, the British Manzel Oil Pump Co., of the City of Carlisle, are now representing them.

Messrs. Alfred Herbert, Ltd., of Coventry, have been appointed sole agents for Great Britain and the Colonies for the plain grinding machines made by the Norton Grinding Co., of Worcester, Mass., U.S.A. They will carry a representative stock of the various sizes of these machines.

The Metallic Seamless Tube Co., Ltd., of Wiggin Street, Birmingham, have made arrangements with the manufacturers to act as wholesale selling agents for the "Brimsdown" metallic-filament lamps. We have received a copy of their price list of these lamps, also advance price leaflets relating to "Metallic" electric bells, pushes, cords, wood blocks and Leclanché cells.

Messrs. J. B. Sykes & W. J. Travis have purchased the financial interest in the Baker Blower Engineering Co., Stanley Street, Sheffield, from the trustees of the late Thomas Somers. There will be no change in the style of the firm, which will continue to have the benefit of the experience of Messrs. T. T. & H. E. Somers. We have received lists describing and pricing Baker's patent rotary pressure blower, also crucible cast-steel and drop forged spanners.

Messrs. J. Sunderland & Co., electrical engineers, Victoria Works, 183, Gibbit Street, Halifax, announce that they are declining business. The plant and stock are to be sold by auction.

Messrs. E.M.F., Ltd., have removed to more commodious premises at 212-213, Upper Thames Street, London, E.C., owing to greatly increased demand for their lamps, fittings and general electrical supplies made at the Walsall works. The business hitherto carried on at Ironmonger Lane, E.C., and at the stores at King's Cross and Pentonville Road, is now centralised at the above new address, where there are head offices, large showrooms, salesroom and general stores, enabling them to give more expeditious execution of orders.

The A.E.G. Electric Co., Ltd., are removing to Pembroke House, 133-135, Oxford Street, W. Telephone No., 8848 Gerrard; Telegrams, "Galvanolon, London."

Bankruptcy Proceedings.—Mr. Paul Schreiber, electrical engineer.—Under a receiving order, accounts have been lodged at the London Bankruptcy Court, showing liabilities £68, and assets valued at £1,000, and consisting of £1,000 debentures, and £200 shares in the Schreiber Electric Battery Co., Ltd. According to the observations of the Official Receiver in charge of the case, the debtor, who has been adjudged bankrupt, states that he is a German subject, and came to this country with about £50 capital in 1901. He has since been employed as an electrical engineer, latterly at a salary of £2 10s. per week; on May 13th last, judgment for £68 was obtained against him in respect of a sum of £50, originally borrowed from a professional moneylender in January, 1908, to enable him to complete a patent electric battery, which he, in February, 1908, sold to the Schreiber Electric Battery Co., Ltd., for £1,000 debenture, and 4,000 1s. shares of the company; on July 4th, 1910, the judgment creditor filed a petition upon which the receiving order was made. The bankrupt denies that he is insolvent, and states that it is because he has, as yet, been unable to realise his interest in the company, that he had not paid all his debts in full. The £1,000 debenture is stated to be held by the solicitors to the company under lien for costs. The Official Receiver has also been notified of two claims to one-third share each of the debenture. The household furniture at the bankrupt's residence is claimed by his wife. The public examination of the debtor is fixed for October 18th next.

Frederick Peacock, electrician, 59, North Station Road, Colchester, Essex.—The first meeting of creditors herein was held last week at the Cups Hotel, Colchester, and later on the same day the debtor attended at the Law Courts, Town Hall, Colchester, for his public examination, before Mr. Registrar H. Goody. The statement of affairs disclosed liabilities £223, and no assets. It

transpired that the debtor had carried on business for nine years, starting with £57 capital. The liabilities are mostly in respect of trade goods supplied. The debtor's sisters claimed the household furniture. He attributed his failure to family illness, and heavy doctor's bills, and admitted knowledge that he could not meet his debts in full for some years past. In reply to further questions, the debtor said that prior to starting on his own account he was employed by a Norwich firm as outdoor representative. Subsequently the case was ordered to stand adjourned.

J. D. M. MORTON, electrical engineer, Nettleton Road, Mirfield.—A receiving order has been made at the Dewsbury Court, on debtor's own petition.

CHARLOTTE RIX, electrical engineer, widow, 78, York Road, King's Cross.—A first and final dividend of 3½d. in the £ is payable September 26th, at 4, Charterhouse Square, London.

HARRY GRAHAM, plumber and electrician, North Street, Lockwood, Huddersfield.—First and final dividend of 4s. 10d. in the £, payable September 23rd, at 1, Cloth Hall Street, Huddersfield.

T. L. CALLENDER (Shamrock Cycle Co.), electrical engineer, Nottingham.—A first dividend of 5s. in the £ is payable September 21st, at 4, Castle Place, Nottingham.

Fire.—The *Times* states that on Saturday morning last seven electric launches, 11 electric motors, and many launch and boat fittings were destroyed in a fire which burnt out one of Andrews's boathouses at Maidenhead. The damage is estimated at £3,000.

Sale of Millbank Street Station.—MESSRS. J. T. WILLIAMS & SONS, of 73, Queen Victoria Street, London, and South Bermondsey, have recently purchased the whole of the installation, together with the buildings, of the old Westminster Electric Light Station, Millbank Street, which has a capacity of over 5,300 KW. The amount is stated at several thousands of pounds.

Installation Contracts.—A large number of electric lighting installation contracts are occupying the attention of MESSRS. DUNCAN WATSON & CO. They include the following outside the London district :—

East Haddon Hall, Northampton.—Taking out acetylene gas plant and installing 14-H.P. oil engine with accumulators. Also complete equipment of electric farm machinery and electric laundry. Also motor-driven pumping plant for water supply with automatic starting and stopping device.
East Haddon Hall Nursing Home.—Complete wiring with underground cables.
Hawkhurst, Kent.—Direct-coupled oil engine set with accumulators, wiring and fittings.
Wittersham, Kent.—Oil engine set, with heating, ventilating and refrigerating plant.
Gomshall.—Two oil-engine plants, with accumulators, wiring and fittings, and overhead mains.
Newbury.—Complete electric lighting plant with storage battery, also ventilating and heating apparatus. Motor-driven pump for water service with automatic starting and stopping device.
Beaconsfield.—Oil-engine plant, storage battery and fittings.
Penshurst.—Oil-engine electric lighting plant with storage battery, wiring and fittings.
Hartfield.—Electric lighting plant, storage battery.
Coley Park, Reading.—Electric light wiring with transformers and metal-filament lamps, underground cable.
St. Albans.—Entirely overhauling electric lighting plant, rewiring and fittings.
Hellingly.—Electric launch with motor-generator, charging plant, switchboard and accessories.
Large hotel, Bournemouth.—Transformers and metal-filament lamps.

The following work is in progress in the firm's hands in London and district :—

Bakers Hall.—Electric light wiring and fittings.
Lloyd & Co.'s Stables, City.—Electric light wiring and fittings.
Hyam & Co., Ltd., Oxford Street.—Electric light wiring, arc lamps and fittings; just completing.
Natural Colour Kinematograph Co.—Electric light wiring, fittings, motors and ventilating fans and accessories.
High School, Muswell Hill.—Electric light wiring and fittings.
Eldorado Theatre.—Electric light wiring and fittings, motor-generator, arc lamps.
Wormwood Scrubbs Prison.—Complete set of transformers and metal-filament lamps.
Refrigerating Works, Limehouse.—Power mains and fixtures.
Church, Clapton.—Electric light wiring and fittings.
New building for a city property company.
West End Art Galleries.—Electric light wiring and fittings.
Dental Manufacturing Co.—Complete electric light wiring and fittings and arc lamps. Ventilating apparatus.
D. H. Evans & Co.'s Extension, Oxford Street.—Electric light wiring and arc lamps.

In addition to the foregoing, a large number of smaller installations are in hand, while orders for over 300 transformers are also on the books.

Aluminium Trade Activity.—A favourable report has been issued concerning the situation of the Swiss aluminium trade. The call for delivery experienced by the Neuhausen Aluminium Industry Co., for instance, is said to be so great that the production can scarcely meet the demand. During the first half of 1910 the exports of aluminium from Switzerland to Germany amounted to 1,349 tons, as compared with 792 tons in the corresponding period of 1909, or an increase of about 70 per cent.

Cotton Mill Driving.—According to reports that reach us electricity is making continued progress in Yorkshire in the driving of textile machinery, and especially of cotton mills; this is evidenced in extensions that are now being made. An order for 50 three-phase 15-H.P. 400-volt 970 R squirrel-cage motors has recently been placed with MESSRS. WRIGHT & WOOD, LTD., of Halifax, for cotton mill driving. We understand that some seven or eight manufacturers of induction motors were invited to submit sample machines to a stringent specification prepared by the consulting engineer with the above result after tests had been made for efficiency, power factor, temperature rise, starting torque, &c. Each ring frame is driven by a 15-H.P. motor with squirrel-cage rotor. The stators are delta wound, and the motors are each provided with a three-pole oil switch fixed at the top of the shell, by means of which the motor is connected direct on to the supply without any other starting device. They thus take five to six times full load current momentarily, starting light, and as soon as they attain full speed the operator, by means of the clutch, connects them to the ring frame. Permanent cables are also laid and run from a plug near each motor to the main switchboard, by means of which each can be separately metered and tested. The mill will be entirely dependent on electricity for its motive power and lighting, which will amount to about 1,000 H.P., and will be driven by three-phase current supplied by the Yorkshire Electric Power Co.'s mains from their Thornhill works. It is believed that this is the first modern cotton mill in Yorkshire to be built and designed originally for electric driving and to be entirely dependent on electricity for its motive power.

New Shipyard for the Tyne.—At a meeting of Newcastle-on-Tyne City Council on 7th inst., a report of the Estate and Property Committee was adopted, recommending the leasing of 55 acres of the Corporation's land at Walker-on-Tyne to Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd., for the purpose of constructing a new shipyard. At present the firm have equipment works on land adjoining that now to be leased, and to this place the great battleships constructed at Elswick Works are sent for completion, but in view of the rapid development of battleships, and the fact that it is with extreme difficulty that these great warships can be navigated through the Swing Bridge at Newcastle—at present there are only a few feet to spare between the vessels and the piers of the bridge—it had become increasingly necessary that other accommodation should be obtained. Hence the application to the Newcastle Corporation. Messrs. Armstrong, Whitworth & Co. have also obtained land from the Newcastle and Gateshead Gas Co., and altogether the site of the new yard covers an area of about 70 acres, and has a river frontage of half a mile. A vast amount of work will be entailed in preparing the new yard, and the work of excavation has been let to Messrs. Edmund Nuttall and Co., of Trafford Park, Manchester. The architects for the yard, &c., are Messrs. Cackett & Burns Dick, Newcastle. It is estimated that clearing the land will cost £200,000, and with the making of the river frontage this will be increased to about £500,000. The rent of the Corporation's land will be about £1,650.

Reflector Fittings.—MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Tyssen Street, Dalston, London, N.E., inform us that they will shortly be placing on the market a series of 18 new prismatic reflectors of the holophane type, specially suitable for metal-filament lamps, and more particularly so for their tantalum lamps. The larger sizes will be very suitable for Messrs. Siemens's new "Onewatt" 100-C.P. lamps, as well as "Onewatt" lamps of higher candle-power which they hope to place on the market shortly.

It is Said.—A correspondent heard on Tuesday that two electrical firms in the Manchester district are about to combine and establish works in Trafford Park. It is also rumoured that two private electrical firms in the same area are about to be floated and converted into limited companies with increased capital. We know nothing further regarding these matters. We merely publish them as rumours that are in circulation, for what they may be worth.

Was this the First?—We have already mentioned two synagogues which were believed to be the first to use metallic-filament lamps. We now hear of another, for a Paris correspondent writes stating that in June, 1909, the Brondesbury Synagogue was lighted with 50 "Orieco" metal-filament lamps supplied by the INTERNATIONAL ELECTRIC CO. Has any other reader anything to say? We always have regarded it as dangerous to say which was the earliest in any connection—there is sure to be an earlier than the earliest turn up from somewhere.

LIGHTING and POWER NOTES.

Aberdeen.—Dr. Westland, convener of the Corporation Electricity Committee, in moving the adoption of the accounts at the meeting of the Town Council, said there was an erroneous impression at the time the flat rate was introduced, that they were making the charge somewhat more than with the other system. That was a complete error. Taking the whole of the electricity sold by meter in the previous year, 1908-9, the actual average cost per unit was about 2·62d., whereas this year the actual average charge per unit was only about 2·4d. That had been arrived at practically, of course, by the increased proportion of electricity for power as compared with the amount sold for lighting. For lighting, the average charge was 3¼d. per unit, and for power, 2¼d., and lower according to quantity consumed. Last year upwards of 100,000 additional units were used for lighting, as compared with the previous year, while for power, which had increased very rapidly in popularity since the new rate, 250,000 units were used more than in the previous year. That had put the results on a satisfactory financial position. The only new proposal was that they should reduce the price of electricity for heating purpose from 1½d. to 1d. per unit. The total costs of production were lowe

than they had ever yet been. The actual cost, not counting the sinking fund and interest, was 81d. They had now got the waste down to 6 per cent., which was very small indeed. The accounts were unanimously adopted. A proposal by Mr. Bell, the electrical engineer, that a trial should be made with the system of giving bonuses to employés, is to be considered.

The Aberdeen and North of Scotland College of Agriculture has applied to the Corporation Electricity Committee for a supply of energy to Craibstone House, Newhills. The necessary extension of the distributing cables will cost £335, and the Committee agreed to grant a supply on condition that the College guarantee a minimum consumption equivalent to £50 per annum for five years.

Accrington.—At the T.C. last week, Ald. Higham, chairman of the Electricity Committee, referred to an application to the L.G.B. for sanction to borrow £16,359 in connection with the Haslingden and Church supplies of electricity, and to cope with future increased demands, as well as the normal extension of mains within the borough. He said the Sub-Committee had purchased machinery in London at a cost of £1,500, and it was satisfied that it would prove of considerable benefit, being the means of saving a considerable amount of capital. Referring to borrowing powers in connection with Haslingden, Mr. Higham said the money was to be spread over a term of years, and in the event of the agreement falling through at the expiration of seven years, a *pro rata* proportion would be repaid to Accrington.

Algeria.—The municipal authorities of Fouka have lately invited tenders for the concession for the establishment of a central station in the town for electric lighting and power purposes.

Australia.—The *Australian Mining Standard* states that the Ararat (V.) B.C. is considering the question of installing electric light, and has approached several firms and also other municipalities who have installed plant. The Creswick (V.) B.C. has agreed to grant a lease of its water reserves to Mr. Buchanan Black, electrical engineer, for the purpose of establishing power stations in the district. The lease will be for 50 years, and the sanction of Parliament will be sought. According to our contemporary, the syndicate for which Mr. Black is acting undertakes to construct a reservoir, estimated to contain 1,760 million gallons, at Bragg's Flat, and to supply the town with 360,000 gallons per diem free. Extra water required will be charged for at the rate of 6d. per 1,000 gallons. At the end of 50 years all permanent waterworks will revert to the Council, which will also have the right to purchase all machinery used in the production of electric power, buildings, &c., at a valuation, plus 10 per cent., or, as an alternative, to renew the lease for further periods. It is stated that about £250,000 British capital can be secured to carry out the scheme, which aims primarily at the production of electric power, and the power stations will be situated about eight miles from Ballarat and three from Creswick.

Mr. W. Reid Bell, Government hydraulic engineer (T.), who is at present preparing reports on the King Island harbours and Stanley breakwater, is to be engaged in connection with the extension of power for the electric light system of the Launceston City Council. A committee favoured the installation of a steam auxiliary plant of 500 H.P., "generated by coal," for the additional power required.

Ayr.—The T.C. has approved of the annual report on the Corporation electricity supply undertaking. It was pointed out that Ayr had now a larger number of electricity consumers per 1,000 of the population than any other city or town in Scotland, but the increased number of units sold for private lighting was small, in spite of the larger number of additional lamps connected. This was accounted for by the extended use of the metallic-filament lamp. The total revenue for the year was £14,867, and the expenditure £6,753, showing a gross profit of £8,113. After paying interest and sinking-fund charges, there remained £2,444, the largest surplus made by the department. Mr. Roland Marshall, the engineer, suggests that all future surplus revenue should go to augment the reserve fund until it reaches a sum sufficiently large to ensure the financial stability of the undertaking.

Bacup.—The Electricity Committee has recommended the Council to purchase from Rawtenstall electricity in bulk from the borough boundary, provided satisfactory terms can be arranged. It has been resolved that the Electricity Sub-Committee be empowered to negotiate terms with the representatives of the Rawtenstall Corporation.

Barrow-in-Furness.—The T.C. has decided to apply to the L.G.B. for a loan of £5,000 for electricity purposes.

Belfast.—The Corporation Police Committee in the course of a few days intends to substitute electric light for gas lighting in Castle Place and its continuation, High Street, down to the Albert Memorial. The Police Committee, as the lighting authority, intends to give the best street lighting obtainable, but for the present only two of the principal streets are to be lighted by electricity, and should the experiment prove successful, it will possibly be extended to others.

Bootle.—The T.C. has decided to apply to the L.G.B. for sanction to borrow £8,500 for expenditure in connection with the Corporation electricity undertaking—£7,500 for the provision of feeder and distributing mains and service mains, and £1,000 for meters.

Bradford.—At the Town Hall a new electrical installation is to be put in, and new telephones and clocks are to be installed in the old portion of the Town Hall in order to bring it into line with the new extension which was opened last year. When the telephones are all fixed there will be 130 of these instruments in the building. The latter work and the fixing of the clocks is being carried out by Messrs. Steinthal & Boydell, of Bradford. The electric lighting (379 lamps) is in the hands of the Bradford Electrical Co.

Braunton.—The P.C. has signed an agreement with Messrs. Crompton & Co. for the establishment of electricity works, on terms in accordance with those recently published in the E.R. Provided the necessary capital is raised, and no difficulty is anticipated in this respect, the parish will have an E.L. installation by August, 1911.

Canterbury.—The B.G. has decided, by 10 votes to 3, to have the workhouse lit by electricity in place of gas. The wiring will cost £165, and it is estimated that the energy consumed will cost about £100 a year, against about £180 for gas.

Canada.—Our correspondent at Ottawa writes:—The western cities of Vancouver, Westminster, and other towns on the lower mainland of British Columbia will soon have a fine supply of electric power. Thirty-five miles to the east of Vancouver there is a hydro-electric power at the mouth of a watershed, so extensive in area, and possessed of such storage capacity, that if all the sources of water supply were absolutely cut off, the generating plants would be able to operate on the stored water for a period of 90 days, and constantly produce 100,000 H.P. during the entire period. This statement is made on the authority of the engineers of the Western Canada Power Co., who are engaged in developing the power which untrammelled Nature is to-day hurling in thousands of tons of swirling water over the falls of the State river, 7 miles from the Ruskin Station, on the Canadian Pacific Railway. The engineers declare that if not a drop of water were added during a period of three months to that stored in the company's vast reservoir above the falls, the plants could still be operated at full capacity. No season of drought can curb the minimum output of electricity. It is the expectation of the company that April, 1911, will mark the delivery of the first electrical horse-power in the City of Vancouver. By the end of that month the first commercial installation driven by the waters of the State river falls should be in operation; the second in July of next summer; the third by Christmas, 1911; and the fourth as soon as desired. What the delivery of this power means for Vancouver, New Westminister, and the entire lower mainland of the province within reach of the copper current-bearing arteries now being constructed beneath a shoulder of the State falls, can only be imagined. Vancouver has now a population of over 125,000, which, 25 years ago, numbered probably a few score of Indians. Other coast cities are likewise growing at a wonderful pace.

The Ontario Power Co., at Niagara Falls, has leased the properties, franchises and future undertakings of the Ontario Transmission Co. to April 1st, 1950, with the privilege of acquiring the property after the bonds have been retired. In consideration of this lease, the Power Co. agrees to pay the Transmission Co., by way of rent, a sum calculated at the rate of $2·50 per annum for each electrical horse-power of the Power Co. transmitted over the Transmission Co.'s lines. The company is under contract to supply power to the Hydro-Electric Commission. The Ontario Power Co. has $5,621,000 capital stock outstanding, $5,768,000 first mortgage, and $3,000,000 debentures. The company's sales of power now aggregate 61,500 H.P. Installations now in progress will increase this output to 82,000 H.P. before the close of the year.

The monthly sales of Niagara power show great improvement in the United States, where transmission lines extend as far as Erie, Pa., and Syracuse, New York. The improvement in the consumption of power in the Canadian provinces is also quite marked. Over the Canadian-Niagara line, the sale of power has increased from $1,653 in September last to $10,968 in July of this year.

Nova Scotia is making efforts to develop her water-powers. In this mountainous province there are many waterfalls, and as a market for the power is available at the various mines, there is only one reason why those cataracts have not long ago been harnessed. The reason is, of course, the abundance of cheap coal to be found everywhere in the mountainous parts of the province. With such a ready supply of coal, it is not probable that very much will be done in the way of hydro-electric power development.

According to the financial Press, the directors of the Northern Light, Power and Coal Co., Ltd., have received a cablegram from their managing director at Dawson City, Yukon Territory, stating that the power-house was completed on August 24th, and current successfully transmitted over 44 miles of transmission line, and supplied under contract to power consumers. A cablegram, dated September 4th, states that the electric plant and machinery are running well.

Cleckheaton.—A L.G.B. inquiry was held on September 6th by Mr. Hooper, M.I.C.E., with reference to the proposal of the Council to borrow £2,210 for electrical purposes, chiefly for cable services.

Colwyn Bay.—A L.G.B. inquiry was held on September 8th into the application of the U.D.C. for a loan of £2,800, it being proposed to extend the mains to Old Colwyn, where a new sanatorium is to be supplied with electricity. Mr. H. R. Hooper, the Inspector, suggested that no further loans should be obtained for services or meters, and that a further £1,000 should be borrowed for mains, so as to obviate applications for small loans.

Continental Notes.—NORWAY.—The municipality of Bergen has made an agreement with the Norwegian Electrical and Brown, Boveri, Ltd., regarding the delivery of the electrical plant for the new municipal power station and transmission of power from the same to the town. This is in connection with the harnessing of the falls on the Samnanger River; the provisional installation is estimated to yield 10,500 H.P., which can be increased to 28,000 H.P. The distance to the town is 22 miles, and the power is to be transmitted at a pressure of 50,000 volts. The same firm has also in hand the electrical plant for Hamar, for which the contract has recently been signed, and it is now installing plant for the small town of Harstad and for the extension of the Stavanger electrical works. The firm has also booked an order for the electrical transmission plant from the Skollenborg waterfalls to Sande. The power to be transmitted is 6,000 H.P., over a distance of 20 miles. The falls at Skollenborg have recently been sold for a purchase price of £5,500.

HUNGARY.—The municipal authorities of Tolna have lately invited tenders for the establishment of a central station in the town for the generation and supply of electrical energy for lighting and power purposes in the town.

AUSTRIA.—The communal authorities of Vienna-Neustadt have obtained powers to contract a loan of 566,000 kronen (£23,600) for the purpose of building and equipping an electrical generating station.—*B. of T. Journal.*

TURKEY.—La Société Union Ottomane pour Entreprises Electriques en Orient has applied for a concession to supply electrical energy for lighting and power purposes in the European quarter of Constantinople.

ITALY.—La Società Italiana di Electrochimica, of Rome, has commenced the establishment of a large electricity generating plant to utilise the water power of the river Pescava. The plant will comprise four 6,600-KW. alternators generating three-phase current at 6,000 volts and 42 periods per second. Each of the alternators will be coupled direct to a turbine; each of the former will weigh about 85 tons without the exciters. The current generated will be transmitted partly to Naples, a distance of 112 miles, and partly to the Torre-Anunziata district.

Durham.—An electrical installation which is to be driven by exhaust steam is about to be laid down at Easington Colliery, Durham. It will consist of a 500-H.P. exhaust-steam turbine fed from the main winding engines. The turbine will drive an alternator providing electric power for the pit, but a stand-by supply of power is to be taken from the mains of the County of Durham Electric Power Co. The advantage of this is that it saves the colliery company the cost of duplicating all its plant, and it also gives a supply of power available at all times.

Falmouth.—The T.C. has decided to take no steps at present relative to the purchase of the undertaking of the Electric Supply Corporation, the capital outlay for which amounts to £29,000. The next option to purchase the undertaking is in 1918.

Fife.—The Property Committee of the Dunfermline T.C. has recommended the latter to grant a feu at Kingseat to the Fife Electric Power Co., who propose erecting a sub-station, the rate to be 9d. per pole.

The Fife Coal Company are completing an extensive system of electrical power in their Leven pit, making it one of the most up-to-date in the country. A year ago electrical plant was introduced for pumping, and instead of the spasmodic delivery of water on the surface given by the engine going at five strokes a minute, there is now a continuous flow of 1,200 gallons a minute. The pump is stationed at the bottom of the shaft, and the motor runs at the rate of 1,400 R.P.M. The condenser is of the multi-jet ejector type, capable of maintaining a vacuum of 27½ in. with the turbine running at full load. There has recently been installed a turbine pump at the foot of the main dock, to assist the existing motor-driven ram pumps. It is capable of delivering 600 gallons of water per minute to a head of 80 fathoms through 900 yards of pipe line. The pump is direct coupled by means of a flexible coupling to a high-tension three-phase motor of 150 H.P. capacity, running at 1,450 R.P.M. The current is conveyed to the motor by means of a three-core armoured cable. An addition to the underground plant has also been made in No. 1 pit, where an extra 75-H.P. haulage has been installed, which has brought the total horse-power driven by the exhaust steam turbine up to 1,265 H.P. in motors. Attention is now being paid to converting the present steam-driven machinery on the surface. Arrangements have also been made to convert the auxiliary steam engines driving the pithead gear. In order that the power may be taken from the high-tension turbo-generator a transformer has been installed which will transform the voltage from 3,000 to 500. The low-tension switchboard will be situated in the power house, and the power will be taken to a distribution box on the low scaffold, from which point the various motors will be fed. To ensure against any stoppage a second set is being laid down. The Curtis turbine plant is of 1,000 H.P., and runs at 3,000 R.P.M. The company have built a commodious power house.

Felixstowe.—The U.D.C. has received from the L.G.B. sanction to a loan of £4,260 for the provision of a Diesel plant and other extensions at the E.L. station. A further loan of £3,000 for mains extensions, house services, meters, &c., has been applied for.

Folkestone.—The Corporation offices are to be lit by electricity.

Glasgow.—The T.C. Electricity Committee has decided that the department should make no contribution to the proposed Corporation fire insurance scheme, seeing that the department have at present no fire insurance reserve fund in their accounts, as was the case with several of the other departments.

Greenock.—The Admiralty have officially notified the Corporation that the supply of electricity required by them for the new torpedo factory at Battery Park will be 400 KW. This is exactly double the original contract.

Halifax.—In its report to the T.C. last week, the Tramways and Electricity Committee stated that it had decided to invite tenders for the supply of plant for the electricity works at an estimated cost of £10,185.

Holmfirth.—The Tradesmen's Association has decided to heartily support the U.D.C. in its proposal to obtain for the district a supply of current for lighting and power from the West Yorkshire Electric Power Co. If there is a sufficient number of probable consumers, the company will extend its high-pressure cables into the district within a year.

London.—POPLAR.—The Electricity Committee reports that in order to make provision to meet an application from Messrs. Fairfields, Ltd., Gale Street, for a supply of 200 amperes, and to cope with the increasing demands of existing consumers in the locality, it is necessary to strengthen the network in Gale Street and alter the existing feeder arrangements. The engineer intends to utilise the feeder to Old Ford as far as the Devons Road end of Violet Road, and lay new cable to Gale Street, fixing the feeding pillar at that point, and to strengthen the network with a 0·2 in. four-core distributor laid through Gale Street for a distance of 200 yards. The cost of this work is estimated as follows:—390 yards six-core feeder cable, £322; excavating and reinstating for cable, £210; feeder pillar, £50; 200 yards of 0·2 in. four-core cable, £74; excavating and reinstating for cable, £107 10s.; establishment charges, £31 10s.; total, £795. Thirty-two street gas lamps are to be converted to electric lighting at an estimated cost of £128. The charge for gas, attendance and mantles now amounts to 58s. per lamp per annum. The charge for current, renewals and attendance when the lamps are converted to 50 C.P., will amount to £2 11s. 4d., or a saving of 6s. 8d. per lamp annually, equal to 11½ per cent., which will gradually increase as the life of metallic-filament lamps is improved and the cost reduced.

HACKNEY.—A showroom for the electricity department is to be opened with some formality on 22nd inst. In connection with the opening of the showroom, two additional clerks are to be permanently engaged. A lady demonstrator and two canvassers are also to be employed, their appointments to be temporary, so that their capabilities may be ascertained. The lady demonstrator will be engaged in the kitchen of the showroom for the purpose of exhibiting the use of the cooking apparatus. In addition to her salary she will be allowed a commission on sales effected by her in the showroom. The fitting up of the premises was carried out by Messrs. Maple & Co., Ltd., during the vacation, their contract price being £428.

Luton.—During a discussion at the T.C. recently on the municipal electric wiring Bill, a Radical member delivered a protest on behalf of private traders in the town. He was only expressing his own opinion, and was not prepared to move an amendment to the report. He said that he believed in municipal trading to a certain extent, but whether it was wise for a Corporation to go into municipal trading on a broad and universal scale was another thing. He thought the tradesmen of the town wanted some consideration, and when they proposed going in for large plant to supply all requirements in homes, warehouses, and so on, and to supplant the honest and industrious tradesman who was trying to get a living, he thought they ought to pause. "I may be one by myself, Mr. Mayor," continued Mr. Gilder. "You are interested in this matter, I know; but it seems to me, if you get this Bill passed, all the electricians of the town, excepting your own men, may take their departure. I do think it wants some consideration before we commit ourselves to this sweeping general request for municipal trading in this particular." He did not want to injure the tradesmen, and the Council ought to be careful.

Morecambe.—During a gale at the end of August the new cooling tower erected at the Corporation electric light works was blown down.

Nelson.—The T.C. has decided to support the M.E.A. Electric Wiring Bill.

Newcastle-on-Tyne.—At a meeting of the Guardians on 9th inst., a report was submitted from the House Committee on the introduction of metal-filament lamps. It stated that for the year ended March, 1909, 62,409 units were consumed at a cost of £780 2s. 3d. (at 3d. per unit), the average number of lights being 1,040; and for the year ended March, 1910, the consumption was 25,256 units, at a cost of £236 15s. 6d. (at 2¼d. per unit), the average number of lights being 1,250. The sum of £28 18s. 6d. had been saved by the reduction of the price per unit, and a further sum of £464 8s. 3d. had been saved entirely on consumption. Therefore, with an increased light, and a larger number of lamps, and after

meeting the cost of the alterations necessary for the installation of the lamps, £418 had been saved as compared with the previous year.

The growing demand for electric light in the Cullercoats district has necessitated some important additions to the mains and stations of the Newcastle-upon-Tyne Electric Supply Co. A new cable (supplied by Callender's), carrying current at a pressure of 5,500 volts, is being laid from Cullercoats to Monkseaton. The object of the main is to give a better supply in the district, and also a duplicate system in case of emergency. In this connection a new sub-station is being built by the company at Monkseaton. An unusually handsome type of building has been adopted to suit the residential character of the district.

The growth of the demand at Monkseaton has also necessitated an increase in the plant of the Newcastle Co. The new sub-station building is situated at the junction of Marine Avenue and Ilfracombe Gardens. It will contain a three-phase transformer by Richardsons, Westgarth & Co., which will transform the current from 5,500 volts to 440 volts. The power for this new sub-station is supplied from the main station at Cullercoats. Some handsome panels of low-tension switchgear by Messrs. Reyrolle & Co., of Hebburn-on-Tyne, are being installed for controlling the low-pressure network of mains.

Norden (near Rochdale).—The surveyor to the U.D.C. has been instructed to get out an estimate of the cost of replacing the electric lamps on Edenfield Road with gas lamps.

Oswestry.—The T.C. has agreed to take current from the E.L. company for the motor pumping station at Whittington Road at £30 per annum.

River Plate.—According to the *Review of the River Plate*, the Maipu municipality in August invited tenders for public electric lighting, and the Parana municipality for an electric tramway. In September the Colon (Buenos Ayres) municipality invited offers for an electric light and power house for public and private lighting. The Zárate Electric Light Co. has been sold to an English syndicate. The concession for an electric light station at Venado Tuerto (granted to Sr. R. Reinholg) has been vetoed.

Rosyth Naval Base.—Messrs. Easton, Gibb & Son are pushing forward the work here as rapidly as possible, and are adding a large number of electric arc lamps to enable the workmen to press on with the work in the night-time.

Settle (Yorks.).—At a meeting of the R.D.C. last week, the minutes of the Hospital Management Committee, which were adopted, contained a report by Mr. Foxcroft upon the system adopted for lighting the hospital. The report stated that the petrolite lamps had proved expensive and unsatisfactory. The three methods which were suggested as alternatives were electricity, air-gas and acetylene gas, electricity being recommended as the most efficient. The matter was fully discussed and consideration was adjourned for a fortnight, Mr. Foxcroft being requested to get schemes and prices from three reliable electrical engineers, and also to ascertain the probable cost of installation.

Sevenoaks.—The U.D.C. has decided to ascertain the cost of a site for a generating station, preparatory to applying for a prov. order for electric light.

Skipton.—The U.D.C. recently decided to install an electric plant in the Town Hall suitable for the purpose of cinematograph entertainments. The work was placed in the hands of Mr. J. Banks, electrical engineer, of Skipton.

South Africa.—According to the *British and South African Export Gazette*, three schemes are under consideration for the electric lighting of Klerksdorp, the estimated cost of realisation being about £9,500.

The proposal of the Potchefstroom Municipality to adopt an electric lighting scheme, at an outlay of £20,000, is forming the subject of a Government inquiry.

The introduction of "Osram" lamps by the Bulawayo Corporation has saved the town over £2,000 per annum in public lighting alone.

The *South African Mining Journal* of August 6th states that electric generating plant is being installed in the Utrecht colliery (Natal), for the purpose of working the colliery by electricity. It is proposed to light the town of Utrecht from the power plant of the colliery, and eventually, although this project is still in the framing, to establish a general system of power distribution in the district for agricultural and industrial purposes.

Stratford-on-Avon.—The plant at the works of the electricity company is to be augmented by a 150-H.P. double-cylinder engine, directly connected to a Bruce Peebles generator.

Stirling.—The Scottish Central Electric Power Co. have been granted permission by the Central District Committee of Stirling County Council to cross certain of the roads with overhead high-tension wires conveying current from Denny to their customers in Stirling district.

Stretford.—The L.G.B. has sanctioned the borrowing of £2,150 for plant at the electricity generating station.

Stockport.—The T.C. proposes to extend the feeder and distributing cables in the Hall Street district, and the cost, with boosters and alterations to the switchboard, will be about £7,000.

Swansea.—The assessment of the electric lighting station has been increased by £758. The T.C. proposes to appeal.

Taunton.—At Tuesday's Council meeting, the Electricity Committee reported that the newly appointed engineer, Mr. A. J. Howard, took over the management on 2nd inst., and they had instructed him to report fully to them as to the general efficiency of the works, and with any suggestions he might make as to the future management of the undertaking, and they then proposed to consult an expert engineer. Mr. E. B. Barton, the charge engineer, had resigned his appointment as from 9th inst., and the Committee had appointed Mr. T. J. Considine, whose time as a pupil expires about that date, in his place, at a salary of £52 per annum.

Tinsley.—Arrangements have been made for electricity to be supplied to works at Tinsley by both the Sheffield and Rotherham Corporations.

Torquay.—The L.G.B. has intimated its conditional sanction to a loan of £4,500 for mains laid during the three years ending December, 1912.

Wakefield.—During the past three years a deficit of £2,250 has accumulated in connection with the Corporation electricity works, largely owing to the introduction of metallic-filament lamps, increase in the amount of rates paid, cost of main extension, &c. The E.L. Committee of the Corporation has considered the matter, and has recommended that from October 1st the price of electricity for lighting purposes be increased to 4½d. per unit, and that a rate of 2s. per quarter be charged for meters. Considering the great saving which light consumers are obtaining from the use of the metal lamp, the Committee feels that these recommendations are reasonable. The General Purposes Committee, however, has determined that the whole question of the payment of the adverse balance shall be deferred until the L.G.B. has given its decision upon the recent application for further borrowing powers.

Walkden.—The new public offices, and town hall and technical school now in course of erection in Walkden Road, will be electrically lighted throughout.

Watford.—At the last meeting of the U.D.C., the clerk stated that a communication had been received from the L.G.B. enclosing five sanctions for electric lighting loans. Councillor Whitlock asked for the letter to be read. Councillor Goodrich said he strongly objected to this being done. The fact of the matter was that there were some strictures at the end of the letter concerning public lighting, and suggesting that the Council should look further into the question of using gas. The answer to that was that 150 street lamps had been converted to metallic-filament lamps and between 30 and 40 were being changed. No good purpose would be served by making the letter public.—Councillor Whitlock said that he was acting in the public interest, and he supposed that the reason that the letter was not read was because it was not very complimentary to the Electricity Committee. It was to be remembered that the gas company were ratepayers, and were concerned to some extent in the matter.—Councillor Rider, after mentioning that he was opposed to municipal trading as a principle, went on to say that it would be absurd for the Council to reveal their secrets to their commercial rivals. The Council told the public anything nice they had to say about the electricity undertaking.—The clerk said that the L.G.B.'s letter was for the information of the members of the Council and not for the information of the general ratepayers of the district.—Councillor Whitlock said he must press for the letter to be read. There was an association opposed to the granting of this loan, and he considered it was only fair that they should know the feelings of the L.G.B.—The chairman (Mr. Mobbs) said that if Mr. Whitlock had the best interests of the undertaking at heart, he would not go further with the matter. It was finally decided to consider the matter in Committee at the end of the Council meeting.

West Bromwich.—On Friday a L.G.B. inquiry was held into the application of the T.C. for a loan of £11,386 for electricity purposes. There was no opposition, but the inspector, Mr. H. R. Hooper, expressed doubts as to the advisability of spending such a large sum in extending the undertaking upon the present D.C. system. He suggested that the Council should consider whether it would not be better to adopt the A.C. system, under which current for power could be generated at a cheaper rate. Mr. W. A. Jackson, electrical engineer, said the question had been very carefully considered, and they thought it advisable at present to go in for an extension of the D.C. plant.

Whitehaven.—The Harbour Commissioners have entered into an agreement with the T.C. for the lighting of the harbour with Osram lamps for five years at £230 per annum.

Wigan.—The Water Department has under consideration a report from the electrical engineer recommending the installing of two electrically-driven centrifugal pumps at the pumping station, Boar's Head.

Wolverhampton.—A loan of £6,740 for extensions to the power plant and refuse destructor has been applied for by the T.C.

TRAMWAY and RAILWAY NOTES.

Ayr.—The manager (Mr. Wm. Grant), in submitting the annual report of the working of the tramways, said that the revenue for the year amounted to £15,007, compared with £15,081 in the previous year. The balance from the year's working was £2,491, of which £1,962 was carried to the depreciation fund, and £528 transferred to the burgh general assessment. £2,986 was expended from the depreciation fund on permanent way and track renewal, and the balance remaining at the end of the year was £8,668. In addition, there was a reserve fund of £5,000. Working expenses, including power, amounted to £8,571—the low rate of 5·30d. per car per mile. 3,588,628 passengers were carried, a decrease of 21,909.

Barrow-in-Furness.—The T.C. has authorised a Committee to consider the advisability of the Corporation's exercising the option of purchasing the undertaking of the B.E.T. Co.

Belfast.—A Sub-Committee of the Tramways and Electricity Committee has had under consideration various extensions of the tramways, and has agreed to recommend extensions to Ormean Road and the Dundonald Cemetery.

Bolton.—The T.C. has decided to lower Manchester Road (near the Burnden railway arches) in order to allow double-decked cars to run on the Moses Gate-Farnworth-Clifton route.

Bradford.—The Tramways Committee on Monday approved a recommendation of a sub-committee to the effect that two vehicles be purchased to be worked by the trackless trolley system, in accordance with the powers granted under the Corporation Parliamentary Bill of 1910. The vehicles will be run between Laisterdyke and Dudley Hill, along Sticker Lane, and, subject to the approval of the City Council, the necessary overhead equipment will be proceeded with as early as possible.

Brierfield.—At a meeting of the D.C., it was reported that satisfactory terms had been come to with Burnley Corporation for the running of tram-cars through the district. The agreement, for 14 years, provided for the payment by Burnley of £1,000 per annum (an increase of £140 per year), and the wiping-off of the debt of £240 on the electric cable laid solely for the purpose of electric traction from the Burnley boundary to Brierfield. The Nelson Corporation had previously supplied the energy under an agreement with the Brierfield D.C., but this will be done by the Burnley Corporation, which is to lay down a new cable at a cost of £1,800. Burnley has, not less than one year before the termination of the agreement, to renew the whole of the permanent way and fittings in the Brierfield district.

Bromborough.—A petition signed by 350 residents and ratepayers has been presented to the U.D.C., urging that body to join the Lower Bebington Council in the proposed extension of the tramways from New Ferry to Bromborough, which is at present two miles from the terminus.

Burnley.—The Tramways Committee has instructed the town clerk to apply to the Board of Trade to sanction a speed of 16 miles an hour on such portions as the Board may approve.

The Tramways Committee proposes to convert 21 "grill" cars into top-covered conveyances.

Continental Notes.—France.—Plans are being prepared for a projected electric tramway between the towns of Avignon and Chateaurenard.

Spain.—La Société des Tramways de Barcelona a San Andres has secured a concession for the construction and working during a period of 60 years of an electrical tramway between Barcelona and Gracia.

Conway.—The T.C. has decided to object to any further extension of time to the Light Railway Co. for completing certain portions of the line scheduled in the order.

Glasgow.—A collision between two tramcars and a traction engine, resulting in injuries to four persons, occurred last week in Canniesburn Road, Maryhill, Glasgow. A traction engine proceeding towards the city was overtaken by a tramcar going in the same direction. The driver of the engine moved to the other side of the road to allow the car to pass, and just at that moment a car coming from the city swept round a curve and ran into the engine with such force that the latter was knocked back on to the other line in front of the city-bound car, which also struck the engine with considerable force. All three vehicles were badly damaged.

The T.C. on Monday inaugurated an experimental east-to-west service—viz., from Alexandra Park to Hyndland—for the convenience of residents on the north side of the city.

The recent decision of the Corporation to use the surplus revenue from the tramways department for the relief of rates has been the cause of a new organisation being formed to carry on an educational campaign in opposition to this new scheme of municipal finance. At a preliminary meeting of the City Association it was agreed to hold a demonstration at the end of this month, after which meetings will be held in the various wards.

Hendon.—At the first meeting of the Council after the vacation, it was reported that Major Pringle, of the Board of Trade, had inspected the route over which it was proposed that railless cars should be run. He suggested that a section of the proposed route from the Tube Station to Edgware Road should be forwarded to the Secretary of the Railway Department, Board of Trade. The request had been complied with.

India.—It is reported in *Indian Engineering* that a proposal is under consideration for establishing a tramway line between Ernakulam and Tripunithura in Cochin.

Little Hulton.—The Finance and General Purposes Committee of the U.D.C. has consented to an application from the South Lancashire Tramways Co. for permission to construct tramways in Little Hulton, provided that the line be constructed within five years, and that the company undertakes to construct a tramway along Clegg's Lane within two years of the passing of the enabling Act of Parliament.

London.—Lewisham.—A conference is to be held between the representatives of the Borough Council and the London County Council, with regard to a proposal of the Highways Committee of the latter body to seek Parliamentary powers to construct a tramway from Forest Hill to Rushey Green *vid* Stanstead Road, Catford Hill and Catford Road.

Malvern.—Having approved of the proposed funicular railway on the Malvern Hills, the U.D.C. has decided to ask the B. of T. to require the promoters to carry out the scheme in two years instead of four, and to have a clause inserted in the order prohibiting Sunday working of the railway.

Manchester.—In order to comply with a request for a tramcar service to the Southern Cemetery, the work of doubling the tramway from Wilbraham Road to the terminus at High Lane, Chorlton-cum-Hardy, has been commenced. A new bridge will be placed at Chorlton (Gore) Brook.

The Parliamentary Sub-Committee of the City Corporation recommends that certain clauses be inserted in the Bill to be introduced in the next session of Parliament, one of which is to authorise the construction of tramways (*a*) along Moston Lane, from the junction of Moston Lane and Kenyon Lane, to Moston Cemetery, and (*b*) along the proposed new street (to be called Wilson Street) from Lamb Lane to Oldham Road.

Meltham and South Crosland.—The U.D.Cs. have decided jointly to approach the Huddersfield Tramways Committee and ascertain if it be agreeable to extend the tramways through to Meltham, and if so, on what conditions.

Newcastle-on-Tyne.—At a meeting of the City Council on the 7th inst., a contract was sealed between the Corporation and Messrs. Edgar Allen & Co., Ltd., for a tramway junction at the corner of Barrack Road and Hunter's Road, the contract price being £252.

Nottingham.—After a lengthy debate the City Council has defeated, by a large majority, a proposal to experiment with halfpenny tram fares.

Plymouth.—Some time ago a deputation from Weymouth went to Plymouth for the purpose of forming an opinion as to the effect of running cars on the value and status of the property past which they ran, and on which their influence might be felt; the question of noise or nuisance; the development or otherwise of the outskirts of the town; and the effect on other traffic in narrow streets. After thorough investigation and inquiry the deputation ascertained that in Plymouth the effect of running cars had been to increase, and not to depreciate, the value of property on the route. To find a house bearing the notification of the fact that it was to let was a matter of extreme difficulty. It was found that in certain cases property and landowners had petitioned the Corporation to run cars to develop the outskirts, and in one case a guarantee was given by a number of owners to insure the route against loss. The guarantors had never been called upon, as the line speedily paid, and a big suburb of good-class houses is now the result. In no case did inquiry elicit any complaints of noise. The noise of other vehicular traffic predominated to such an extent as practically to shut out the sound of the cars. That the cars had produced expansion of the town they found was an incontrovertible fact. On each side of the route houses had sprung up and suburbs had been formed. Vehicular traffic did not appear to be in any degree affected by the tramways.

Rochdale.—The Board of Trade inspection recently took place of the tramway extension from Rochdale to Facit. The section was afterwards opened for traffic. It is proposed further to extend the tramways to Bacup.

Rossendale.—The first setts were raised in connection with the Rawtenstall Borough Tramways extension up the Lumb Valley on Monday morning by the Mayor and Councillor Coupe (chairman of the Tramways and Electricity Committee). The undertaking will involve an outlay of £30,000, and the line will reach from Waterfoot to Water. Messrs. Underwood, of Dukinfield, are the contractors.

South Africa.—According to an exchange, a sum of £7,050 has been provided in the Johannesburg municipal estimates for the purchase of sundry materials, tools, &c., for the tramways department.

Stretford.—The Manchester Corporation has been in communication with the U.D.C. with regard to provision being made in the proposed Parliamentary Bill of the Corporation for an extension of time for the construction of the Southern and Stretford tramway authorised by the Stretford District Council Act, 1904.

The opinion of the Parliamentary agents that they do not anticipate any difficulty in this direction has been communicated

to the U.D.C., and the latter has written to say that it would be pleased to accede to the suggestion that powers should be sought in the Bill for the completion of the tramways.

Torrington—Halwill Junction.—Messrs. James Oag, Holman Fred Stephens (of Tonbridge), and Harold Rylett have applied to the Light Railway Commissioners for an order to construct light railways between Torrington and Halwill Junction (Devon).

Wigan.—The question of the tramways undertaking was again under consideration at the last meeting of the T.C. The construction and extension of several loops in different parts of the town, and the purchase of six new cars, had already been decided upon by the Tramways Committee, but at the Council meeting the chairman of the Committee (Alderman Ashton) moved that these recommendations be referred back pending a report from their own traffic manager. He thought that they should first give effect to the suggestions as to the improvement of the service with their present rolling stock before incurring further expense. After some discussion the chairman's proposition was carried, on the understanding that the Tramway Committee's recommendations should be based on the whole of Mr. Mallins's report, and brought before a special meeting of the Town Council.

TELEGRAPH and TELEPHONE NOTES.

Australia.—Dr. Graham Bell, who has been visiting New South Wales, and has been royally entertained there by the postal and electrical services, has taken the opportunity of pointing out that the State is trying to run the telephone service below actual cost. Much of the inefficiency of the service also is due to the delay of subscribers in replying to calls.

Pacific Cable.—Mr. A. S. Baxendale, London manager of the Pacific Cable Board, who has returned from Canada after supervising the transfer to the Board of the new direct wire between Montreal and Bamfield Creek cable station, reports that a considerable improvement in the accuracy of transmission has already resulted from the change. The Board rents the line, for a payment of £11,000 a year, from the Canadian Pacific Railway, which maintains it, the agreement being made for five years. A saving of 15 minutes in the time of transmission from London to Australia is anticipated. Regarding the question of reduction in cable rates by the adoption of a system of deferred messages at lower rates, which we have often advocated, the *Times* states that the British postal authorities have declined to sanction the system, on the ground that it has not been approved by the International Convention, which does not meet again for four years.

Wireless Telegraphy.—The *Financial News* states that the Marconi Co. has obtained an order for fitting with wireless telegraphic installations 11 Turkish warships, and a station on the coast, which will probably be at San Stefano.

Experiments have been successfully carried out in the transmission of messages to British submarines, but not, as yet, in the reverse direction.

The Australian Federal Government has agreed to pay the extra sum of £2,000 asked by the contractors on account of the change in the situation of the wireless station to be erected near Sydney. The site will be chosen in the Pennant Hills, 13 miles from Sydney, and sufficiently far from the sea to ensure safety from bombardment by warships. The total cost will be £6,150.

The installation of a wireless station at Cape Town, and possibly an intermediate station between Cape Town and Durban, is under consideration. The former would form a link in the proposed Marconi chain of "all-red" stations at Bathurst, St. Helena, Cape Town, Maritzburg, Mauritius, Ceylon, Straits Settlements, and China and Australia.

Upon the return to Liverpool of the "Wireless" Company of the Western Telegraph Companies (T.), Royal Engineers, from their training at Aldershot, it was ascertained that their official inspection had given the utmost satisfaction. The majority of the members of this detachment are associated with the electrical industry in Liverpool. The officers in camp were Capt. P. Barrett Coulston, R.E. (T.), in command, and Lieuts. A. C. Heap and W. Bottomley.

CONTRACTS OPEN and CLOSED.

OPEN.

Austria-Hungary.—October 1st. A copy of the specification issued by the municipal authorities of Mostar, for tenders for the installation of plant for the supply of electricity to the town, has been received in London from the British Consul. Tenders should be addressed to the Stadtmagistrat, Mostar, Bosnia-Herzegovina. The specification (in German) may be seen by British firms at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Australia.—September 20th. Telegraph and telephone material, for the P.M.G.'s Department in Victoria. See "Official Notices" August 5th.

September 27th.—Electric lamps for the P.M.G.'s Department in Victoria. See "Official Notices" August 12th.

October 4th.—Telegraph and telephone insulators for the P.M.G.'s Department in all States. See "Official Notices" August 12th.

October 4th.—Telegraph and telephone material, for the P.M.G.'s Department in Victoria. See "Official Notices" August 19th.

October 4th.—Telephone material, for the P.M.G.'s Department in Victoria. See "Official Notices" August 19th.

October 5th.—5,000 porcelain insulators, for the P.M.G.'s Department in New South Wales. See "Official Notices" August 19th.

October 17th.—Telegraph and telephone material, for the Deputy Postmaster-General, Hobart. Commonwealth High Commissioner's Office, 72, Victoria Street, London.

VICTORIA.—Telephone cable and insulators, for the P.M.G.'s Department in Victoria. See "Official Notices" September 2nd.

MELBOURNE.—H.M. Trade Commissioner for Australia (Mr. C. Hamilton Wickes) reports that tenders will be received at the office of the Deputy Postmaster-General, Melbourne, as follows:—October 18th, for 23 miles of telephone cable (Schedule No. 284), and 500 composition insulators (Schedule No. 374); October 25th, for 10,000 Cordeau inslators (Schedule No. 373).

TASMANIA.—October 17th. Telegraph and telephone instruments and material, for the P.M.G. See "Official Notices" September 2nd.

Birmingham.—September 30th. 78,000 tons of coal for the generating stations of the T.C. R. A. Chattock, city electrical engineer and manager, 14, Dale End.

Bradford.—September 21st. Coal for a year, for the electricity works. T.C. Electricity Offices, Town Hall (returnable deposit of 10s. 6d.).

Calcutta.—September 19th. Motor-generators, turbo-alternators and condensing plant for the Cossipore station and sub-stations of the Calcutta Electric Supply Corporation, Ltd. See "Official Notices" August 26th.

Chile.—September 30th. Three dynamos and search-lights, also machines and tools, for the Chilian Navy. See this column in last issue.

China.—SHANGHAI.—October 10th and 20th. The *North China Herald* of August 12th contains a notice to the effect that tenders are invited by the Shanghai Electricity Department for the supply of the following:—(1) Electric heating and cooking appliances (tenders October 10th); (2) 10,700 carbon-filament lamps (tenders October 20th); (3) 15,000 metallic-filament lamps (tenders October 20th). Sealed tenders, marked "Tender for Heating and Cooking Appliances," or as the case may be, should be addressed to the Acting Secretary, Council Rooms, Shanghai. Conditions, specifications and forms of tender may be obtained from the Electrical Engineer, Electricity Works, 31, Fearon Road, Shanghai, on payment for each specification of 10 taels, which will be returned on receipt of a *bona fide* tender.—*Board of Trade Journal.*

Edinburgh.—October 10th. Steam turbines, A.C. generators, condensing plant, and internal parts of cooling towers. See "Official Notices" to-day.

Egypt.—October 20th. Electrical installation and refrigerating plant, for asylum at Khanka. Specification from Chief of Administrative Service, Public Works Department, Cairo; for particulars as to tendering see *Board of Trade Journal.*

October 31st.—According to the *Standard*, tenders are invited by the Ministry of the Interior, Cairo, for the supply and installation of machinery, &c., required for the establishment of water supply and electric light systems in the town of Beni-Souef. Tender forms obtainable from Mr. A. L. Webb, C.M.G., Queen Anne's Chambers, Westminster, S.W. The specifications, drawings, &c., may be obtained on payment of 200 piastres (£2 1s.). A deposit equal to 2 per cent. of the value of the offer is required with each tender.

France.—November 1st. The Prefect of the Department of the Yonne, at Auxerre, is inviting offers for the construction of a system of metre-gauge electric or steam railways in the Department, the aggregate length of the proposed lines being about 233 kilometres.

French Equatorial Africa.—The French Ministry of the Colonies in Paris (57, Boulevard des Invalides) is organising a competition for the supply and laying of a submarine telegraph cable between Libreville and Loango-Porte Noire, in French Equatorial Africa.

Isle of Thanet.—October 1st. Supply of general stores for the year for the Isle of Thanet Electric Tramways and Lighting Co., Ltd. See "Official Notices" to-day.

London.—HACKNEY.—Tenders are to be invited for the supply of 80,000 pairs of white arc-lamp carbons.

Margate.—October 17th. Dust destructor, for the T.C. E. A. Borg, Borough Surveyor, 13, Grosvenor Place.

Mozambique.—October 12th. The authorities of the Harbour and Railway at Lourenco-Marques, Mozambique, are inviting tenders for the supply of seven electrically-operated cranes, ranging in capacity from 1 to 10 tons.

Newport.—September 20th. Material required for extension works, for the Corporation Electricity and Tramways Committee. See "Official Notices" to-day.

New Zealand.—December 15th. Installations of wireless telegraphy at Doubtless Bay, Gisborne, Cape Farewell, Sumner and Bluff. See "Official Notices" August 5th.

Rhyl.—September 26th. Fuel oil for the U.D.C. Electricity Department for 12 months. Particulars from Mr. E. H. Wright, at the Electricity Works.

South Africa.—DURBAN.—September 28th. Elevated jet condenser and piping, switchboard, rotary converters, cables and transformers, for the Corporation. See this column last week.

September 23rd.—According to *African Engineering*, the Kleinfontein Group of Mines invite tenders for five electrically-driven winders for loads of 10,000 and 4,000 lb. No especial system is specified. The supply is three-phase at 3,000 volts.

Spain.—The municipal authorities of Nerva (province of Huelva) have just invited tenders for the concession for the electric lighting of the town during a period of 10 years.

Uruguay.—September 30th. The equipment of an electric generating station and the supply of electric light at San Fructuoso. See this column last week.

Walthamstow.—The U.D.C. has decided to invite tenders for a new battery for the electricity station.

CLOSED.

Atherton.—The U.D.C. has accepted the tender of Callender's Cable Co. for 1,410 yd. of concentric cable.

Australia.—SYDNEY.—Our contemporary, the *Australian Mining Standard and Electrical Record*, reports that the E.L. Committee of the Council has accepted tenders as follows:—

Coal and ash handling plant.—Babcock & Wilcox, Ltd., £5,887.
Steel suspension cable (17 miles).—Bullivant's Australian Co., Ltd. (11 weeks), £306.
Seventy-five steel poles.—Stewart & Lloyds, Ltd. (three weeks), £103.
Fifteen miles 11,000-volt cables.—W. T. Henley's Telegraph Works Co. (in place of £4,760 tender now rescinded), £4,760.

One H.T. 5,000-volt feeder panel, and two H.T. 5,000-volt transformer panels of the Ferranti type are to be purchased for extensions at the Pearl Street sub-station, in connection with the supply to Randwick and Little Bay, at a cost of £250.

The same contemporary states that the tender of Messrs. Kynoch, Ltd., for the installation of a producer gas plant (104 B.H.P. engine and 150 B.H.P. generator), at £1,700, for the New Prince of Wales Gold Mining Co., of Bendigo (V.), has been accepted.

Batley.—The Council has accepted the following tenders:—

Bertram Thomas.—Switchboard.
Tudor Accumulator Co., Ltd.—Traction battery.

Bradford.—The Technical College and School of Art Sub-Committee of the Corporation is to recommend the City Council to accept the following tenders for electrical equipment:—

Motor alternator set.—Bruce Peebles, Ltd., £190.
Shunt machine set.—British Westinghouse Electric & Mfg. Co., Ltd., £75.
Series motor.—Greenwood & Batley, Ltd., £29.
Single-phase commutator motor.—Lancashire Dynamo Co., Ltd., £53.
Motor-converter set.—Phœnix Dynamo Manufacturing Co., £105.

Bristol.—The Electrical Committee of the T.C. has accepted the tender of the British Westinghouse Electric & Manufacturing Co., Ltd., for two three-phase 3,000-KW. steam turbo-alternators, at £25,290.

Colchester.—The T.C. has accepted the following tenders for coal for the electricity works:—

Mellome & Goulder, Ltd.—Butterly (Kirkby) No. 1 slack, at 12s. 9d. per ton, delivered; and Portland 1½-in. slack, at 12s. 10d.
A. J. Hayward.—Butterly (Kirkby) No. 1 slack, at 12s. 10d. per ton, delivered.

Dover.—The T.C. has accepted the tender of the Featherstone Co., for coal for the electricity works, at 11s. 9d. per ton; and that of Messrs. Babcock & Wilcox, Ltd., for two chain grate stokers, at £340.

Elland.—The Electricity Committee of the U.D.C. has accepted the tender of Messrs. Sykes & Sugden, for 12 straight through boxes: and that of the Gath Electrical Engineering Co., for a year's supply of tantalum and Sun lamps.

Gosport.—The U.D.C. has accepted the tender of Mr. W. M Walters, for installing the electric light at the Council Offices at £55 11s.

Hastings.—The T.C. has accepted the tender of the Main Colliery Co., of Neath, for naturally worked Welsh through and through steam coal, for the electricity works, from September 1st to March 31st, 1912, at 18s. 6d. per ton, delivered free.

Heywood.—On the recommendation of the Gas Committee, the T.C. has accepted the tender of Messrs. John Brotherton, Ltd., for tubes and fittings.

London.—The contract for the complete electrical equipment of the Palladium Theatre of Varieties, Argyll Street, Regent Street, W., has been placed with Messrs. Siemens Bros. Dynamo Works, Ltd., who have sublet the wiring work to Messrs. Rashleigh Phipps & Co.

Lowestoft.—The tender of Messrs. Walter Scott, Ltd., of Leeds, for 50 tons of rails, at £6 15s. per ton, has been accepted by the Tramways Committee, also that of the Standard Cable Manufacturing Co., for the supply of one mile of overhead trolley wire, at £67.

Luton.—The T.C. has accepted the tender of Messrs. E. Green & Son, Ltd., for 12 sections of pipes for the refuse destructor, at £75.

Montrose.—The offer of Messrs. A. & P. Steven, Glasgow, to supply an electric power lift for £202, and a hand service lift for £18, to Montrose Infirmary, has been accepted.

Sheffield.—The T.C. has agreed that Gilbert Heathcote and Co., sub-let the following work in connection with the extension of the Neepsend power house:—

Steel work.—Skipwith, Jones & Lomax, Ltd., Trafford Park, Manchester.
Steel troughing.—Widnes Foundry Co., Ltd., Widnes.

Stockport.—The Electricity Committee of the T.C. has accepted the tender of Messrs. J. and R. Higginbotham, of Stockport, for Pilsley hard slack, at 8s. 6d. per ton; that of Messrs. Walter Thorp & Co., for Denby nutty slack, at 8s. 7d. per ton; and that of Dussek Bitumen Co., for bitumen, at £5 10s. per ton.

The Tramways Committee has accepted the following tenders:—

Morgan Crucible Co.—Carbon brushes.
H. Hollingdrake & Son.—50 draw chains, 16s. per cwt., iron tubing, nuts and bolts and ironmongery.
J. G. Bradwell.—Iron castings.
British Insulated and Helsby Cables, Ltd.—Overhead line materials.
Wilkinson, Heywood & Clarke.—Paints and varnish.
F. R. Smith & Co.—Waste, &c.

South Shields.—The T.C. on September 7th accepted the tender of the Chatteris Engineering Co. for a 5-ton overhead travelling crane for the Tramways Department. There were 31 tenders submitted.

Wallasey.—The offer of the Lancashire Dynamo & Motor Co., Ltd., to supply a new armature for No. 3 Traction set at the electricity works, at £500, has been accepted by the U.D.C., also that of the Davenport Engineering Co. (£525) for a water cooling tower.

Walsall.—The T.C. has accepted the tender of the British Westinghouse Electrical and Manufacturing Co., Ltd., for supplying and fixing the new rotary converters and switchgear for the sum of £1,145; also the tender of Messrs. Callender's Cable and Construction Co., Ltd., for laying the high-tension mains for Darwall Street, Birchills, Pleck and Bescot, and Bloxwich, for £5,026.

Whitehaven.—The Corporation has placed an order with Ed. Bennis & Co., Ltd., of Little Hulton, Bolton, for the supply of four Bennis stokers and self-cleaning natural draught furnaces, for B. and W. boilers, to its electricity works.

FORTHCOMING EVENTS.

Municipal Tramways Association.—September 21st to 23rd. Annual conference at Bradford.

The North of England Institute of Mining and Mechanical Engineers.—September 23rd. Excursion to Blackhall Colliery.

Association of Engineers-in-Charge.—September 24th. Visit to the Naval Mercantile Marine and Engineering Exhibition, 5.15 p.m. Lecture on "Wireless Telegraphy; its Maritime Importance," by G. Langler Bullock, 7.45 p.m.

Inquiries.—A correspondent wishes to be put in touch with a firm that would make a wheel of compressed asbestos for him.

A correspondent wishes to receive the names and addresses of makers of small electrically-operated annealing furnaces, giving a constant temperature of 1,200-1,400° C.

The manufacturers of appliances for transferring names on to the bulbs of electric lamps are asked for.

The maker of the "Hudson" economiser is asked for.

NOTES.

Australia as a Field for Engineering Appointments: Outlook not Hopeful.—Mr. W. A. Prescott, one of the first electrical engineers trained at the Sydney University, who recently arrived in Australia from London after several years' experience in England, was interviewed by one of the Australian newspapers concerning the prospects offered by Australia as a field for electrical and other engineers. He appears to have drawn attention to what he regards as a serious aspect of the question. "We have an excellent school in the P. N. Russell School of Engineering at the University. But there is a really difficult problem in the question of how the engineers who are educated there are to be kept in the country. There are a number of Sydney men in good billets in the Western Australian mines. But there is very little private enterprise in engineering here, compared with what there is in England and elsewhere. Except for places in Government departments, there are not many places which are open to engineers in Australia at present. Private capital is not much used in the big works for developing Australia—and it is quite right for the Government to carry them out, for they would otherwise probably not be carried out at all. But in the old country big works, like the Barren Jack Dam or the various municipal waterworks, would be carried out by private firms; and in the old country it is by those private firms that a great part of the young engineers are absorbed after their training. The Forth Bridge, the Assouan Dam, the great works that are now being undertaken in Chile, and all that type of big engineering work in other countries have been in the hands of private firms of engineers, and they absorb a great part of the engineers who are trained elsewhere. In Australia the work is undertaken by the Government. As I say, I think it is a good thing, for otherwise it would not have been undertaken at all. But it leaves the problem of how Australia is to keep her own engineers within her borders. At present a great proportion of the men who have been trained here go off to the East—to Borneo or Burmah, or other places where capital is being invested in big private enterprises—owing to the absence of billets for them in Australia. I think that the real cause of the difficulty is the want of population in Australia. If the population were 20 millions there would be plenty of opening for private enterprise besides the Government enterprise in Australia. A big increase in its population is, to my mind, the real solution."

Copper.—Messrs. Merton's monthly statistical circular for the end of August shows visible supplies at 97,506 tons, a decrease of 1,733 on the return for the end of July. Since February 28th last, when stocks in Europe stood at 113,455 tons, the reduction has been 15,949 tons, or, striking an average, 2,658 tons a month. Against the withdrawals has, of course, to be reckoned the rate of supply from Chile and Australia. Australian shipments afloat are reckoned only 275 tons better than for the end of July, but Chilian are 1,400 tons better. Deliveries from North America to English ports are still low, 4,728 tons, against an average of about 7,000. To other European ports the quantity is above average (for the past 12 months). Spanish deliveries are about average, Chile above, and Australia 4,550 tons, against an average of 3,200. Deliveries are brisk at 41,407 tons, though lower than last month. Messrs. Merton now add to their circular the figures for American stocks, as given by the American Producers' Association. These stocks have increased since the end of January, when they stood at 43,957 tons, to 76,179 tons for the end of July. During March, April and May the increase was at the rate of about 8,000 tons per month. During July it was only 1,000 tons.

The Staff of Amalgamating Works.—It is stated that considerable disquietude prevails among the officials of the Felten & Guilleaume-Lahmeyer Works in consequence of the contemplated amalgamation of this firm with the A.E.G. of Berlin. The anxiety has been occasioned by certain events which took place a few years ago in connection with similar fusions in the electrical engineering industry—this all the more because the efforts at combination, which lead to a reduction in the *personnel*, are becoming still more apparent in the trade. As the results of the projected amalgamation in question cannot be foreseen in the circles of the officials concerned, the hope is expressed, on behalf of the latter, that the principals will take these apprehensions into consideration, and that, if dismissals are proposed on a large scale the notices should not be given all at once, but in a gradual manner, in order that, as far as possible, injury may not be caused to the officials. In commenting on this statement, a German newspaper remarks that it remains to be seen whether the apprehensions will prove to be correct. As is known, the A.E.G. proposes to devote considerable capital to the development and extension of the Lahmeyer Works at Frankfort. Moreover, as a separate commercial administration is to remain in that city, it is not probable that in this event, the staff will be considerably reduced. If, however, discharges are necessary, it is hinted that they should, as suggested on behalf of the officials, be proceeded with in a gradual way.

Canadian Electric Amalgamation.—The *Birmingham Post* correspondent at Montreal states that the Montreal Street Railway Co. and the Canadian Power Co. have amalgamated. The new combine, which will be capitalised at $60,000,000, is expected considerably to improve both the tramway service and the city's power supply.

Lamp Taxation Results in Germany.—The quarterly issue which has just been published by the German Imperial Statistical Board gives for the first time particulars relating to the taxation of illuminating articles, which was brought into operation on October 1st, 1909; the information refers to the six months ended with March 31st, 1910. It appears that the number of factories or workshops concerned during this period was 175, the total production of which was as follows:—

Production in Six Months.

Carbon-filament lamps	13,994,323
Metallic-filament lamps	17,828,730
Nernst burners	253,456
Mercury vapour lamp burners	4,541
Incandescent gas mantles	61,380,188
Arc lamp carbons (pure carbon) in tons ...	4,360
Arc lamp carbons (flame carbons) in tons ...	1,034

It will be observed with some interest from the figures that the output of wire lamps, as was mentioned in this journal recently, in connection with the position of the International Glow Lamp Syndicate, has already largely outstripped that of the carbon-filament lamps, and this tends to confirm the belief that unless the former are also brought within the scope of the syndicate, the latter will eventually collapse. The imports from other countries in the six months comprised 566,115 carbon lamps, 141,407 metallic-filament lamps, 418 Nernst burners, 79 burners for mercury-vapour lamps, 20,784 incandescent gas mantles, 11·75 tons of arc lamp (pure) carbons, and ·693 ton of flame arc carbons. The revenue from the taxes on the articles in the six months was as undernoted:—

Yield of Taxes in Six Months.

Carbon-filament lamps	£47,251
Metallic-filament lamps, Nernst burners, &c. ...	78,561
Mercury-vapour lamp burners	557
Incandescent gas mantles...	76,347
Arc lamp (pure) carbons	36,407
„ (flame) „	20,591

The total revenue from the above sources will be found to amount to £259,714, a sum which is probably less than was estimated when the taxes were first proposed by the Government.

Reading Tramways Church Parade.—On Sunday morning last, the fourth annual church parade in connection with the Reading Corporation Tramways Department took place. The general manager, Mr. W. Binns, and officials of the department were present, and about 100 men took part in the parade. A collection was made on behalf of the Royal Berkshire Hospital, and after the service the men marched back to the depôt, where they were formed up in square, and were addressed by the chairman of the Tramways Committee, Mr. Alderman C. G. Field, J.P., who complimented the men on their smart appearance, and congratulated them upon the success of the parade.

I.M.E.A. Proposed Bill for Further Powers.—The following additional towns have signified their intentions of giving support to the Bill:—Burton-on-Trent, South Shields, Luton, Nelson Oban, Redditch and Neath.

Illumination.—Before the Royal Sanitary Institute Congress held at Brighton, Mr. John Darch read a paper on practical illumination, in which he said his object was to show that the principles governing the practice of lighting should be in strict conformity with the hygienic requirements of the eye, and also to lay down certain rules thereon. Having referred to the pathological and physiological aspects of the question, he said the conditions essential to good artificial illumination were: (*a*) A sufficiency of light; (*b*) perfect steadiness; (*c*) effective diffusion and freedom from violent contrasts; (*d*) a downward direction and preferably oblique, and (*e*) the colour to be as white as possible. However readily these conditions might commend themselves, it was not too much to say that they were violated in nearly every lighting installation in the kingdom, whether of gas, electricity or what not.

Insufficient lighting in schools, offices and workshops was largely responsible for the increase of myopia, astigmatism and many attendant nerve troubles, but, so far as artificial lighting was concerned, the ever-increasing brilliancy and cheapening of light, properly applied, made the remedy easy. For reading and ordinary work there should be an illumination of from ·8 to 1·5 ft.-candles, for drawing and fine work, 3 to 10 ft.-candles. High brilliancy in lighting did not, in itself, deserve the hard words which some had applied to it. Like all other forms of energy, light was a good servant, but a bad master; it was a source of health and pleasure, and the more they had of it under control, the greater the possibilities of good results. But glare from ill-placed and ill-tempered lighting was responsible for much suffering. Proceeding, the author said the dazzling effect of a source of light might be due to its intensity, its composition, or its contrasts. He asked the engineer to remember the simple axiom that the purpose and object of artificial lighting was to make properly visible the things required to be seen, and suggested that (1) The lamps or other sources of light should be so arranged that they were not visible from the more frequented or ordinary points of view; (2) the illumination should be sufficient to cause the objects to appeal at once to the eye, but should be free from glare; (3) for general illumination the light should have a preponderating downward direction, freely flooding

ceilings and walls, uniformly distributed and fully diffused; (4) special work at desks, benches, &c., should have special lighting, adjustable in position and power, with opaque shades; (5) the colour of the light should be as pure and white as possible. Monochromatic light should, as a rule, be avoided. If architecture had any power to charm, that power could only take effect when it was subjected to suitable lighting, and it was curious that this truism was so completely overlooked as one might see in any public building. He always preferred direct lighting, so far as it would accord with the rules he had laid down. The practice of placing glaring high-power lamps in the front of shops was especially foolish and dangerous. The lighting of the average church had, perhaps, more than any other class of building transgressed the most elementary principles of good lighting; whilst concert and lecture halls were, as a rule, little better illuminated than churches. Lofty halls were best illuminated by direct lighting from the ceiling. Street lighting was at present extremely unsatisfactory; there was no diffusion, no reflection, nothing but a blinding display of lights in a background of darkness, that amidst motor-cars and the like but served to bewilder the bravest. He asked why these intense lights should not be shaded, and the exteriors of the buildings, as well as the pavements, illuminated. He thought it would have to come by-and-by.

Institution and Lecture Notes.—Association of Engineers-in-Charge.—At the annual general meeting the chairman, Mr. A. E. Penn, was able to give a very satisfactory account of the Association from all points of view, and the statement of accounts presented by the hon. secretary, Mr. Hy. Capsey, was adopted unanimously. The whole of the retiring councillors were returned unopposed. Messrs. Knight and Lee, the auditors, were again elected as were also the indispensable and indefatigable hon. secretary, Mr. Hy. Capsey, the hon. librarian, Mr. J. Ryan, and the hon. treasurer, Mr. Hy. Swann. Very cordial votes of thanks were accorded these officers for their past services, and the same compliment was also paid to Mr. W. T. Pickett and Mr. W. H. Ball, chairman and hon. secretary respectively of the Social Committee, for their untiring efforts to promote the social welfare of the Association. The chairman, in returning thanks for their re-election, regretted that there had not been a contest for some of the vacancies, as new councillors brought new ideas and had many ideals to bring forward. The president-elect was Capt. H. Riall Sankey, R.E. (ret.), M.Inst.C.E., &c.

Institution of Electrical Engineers (Manchester Students).—The Committee is inviting offers of papers to be read during the coming session.

Mining Institute of Scotland.—On Saturday, 10th inst., the annual excursion took place to Broxburn, where the members were the guests of the Broxburn Oil Co., Ltd., and were conducted over the Broxburn Works Refinery, the Broxburn Crude Oil Works, and the New Dunnet Mine, in which an electrical installation has just been completed. In a paper submitted by Mr. William Clark, of the Broxburn Oil Co., the author gave an interesting description of the firm's shale mines, in which the motive power chiefly employed is electricity, obtained from a central power station placed alongside the works boilers, and within a few yards of the retorts, in which all the exhaust steam from the engines is utilised. The generating plant at present consists of one Belliss and Morcom engine, working at a boiler pressure of 90 lb., with 1 lb. back pressure (for forcing the exhaust steam into the retorts for the production of ammonia water), coupled to a Siemens three-phase alternator, which furnishes current at 525 volts and 50 cycles, giving 470 kilovolt-amperes at 300 r.p.m. There is an exciter on the engine shaft of a capacity of 245 amperes at 110 volts; this gives more current than is required for the machines, and the surplus is used to supply the various lamps in the works during the day. The power station building is constructed to hold two more generating sets. The alternating current is delivered to a remotely-controlled switchboard, consisting at present of one generator panel; one 200-h.p. feeder panel for the Dunnet Mine pumps underground; one 200-h.p. panel for the Dunnet Mine haulage, and one 200-h.p. breaker panel. Current is sent to the various points in paper-insulated armoured cables. The Dunnet Mine pump underground panel will supply current to a 185-h.p. Siemens-Sulzer pump, 50-h.p. motor-generator for electric drills, 150-h.p. double-drum haulage, 25-h.p. dook pump and 7-h.p. hutch creeper. The Dunnet Mine endless rope haulage gear is driven through belts by two motors, each of 110 h.p., and controlled by oil switches, each with a maximum cut-out, time relay and no-volt release. This release is so arranged as to stop the motors automatically in case of runaway hutches, and by push buttons from various convenient points in the mine. The breaker panel supplies a 110-h.p. motor for driving the shale breakers, one 50-h.p. endless rope haulage motor for filling a 2,000-ton bunker with broken shale, and one 25-h.p. motor for hauling shale from the Stewartfield Mine to the breakers, and from the Dunnet Mine main haulage to the breaker. All the motors on this work are of the slip-ring type, with liquid starters, excepting the motors of the high-speed turbine pumps, which are squirrel-cage, with star-delta starting arrangement. The lighting of the works here is done by a 75-h.p. Belliss-Siemens d.c. set, giving 455 amperes at 110 volts, and 525 r.p.m. There is one earth-bar in the power house, connected by cable to an earthing plate, which is laid in clay, and also to the earth-plates of two adjoining chimneys. All earth connections on the various switches, motors, and starters, conduits for lighting purposes, &c., are made on to the armouring of one or other of the main cables, and these are in their turn connected to the common earth-bar in the power station.

The permanent pumping plant consists of a Sulzer high-lift centrifugal pump, direct coupled to a Siemens-Schuckert electric star-delta motor of 185 b.h.p., running at 1,470 r.p.m., when supplied with current at 525 volts and 50 cycles. The combined set is capable of pumping 400 gallons of water per minute to a head of 780 ft., plus the friction of 1,740 ft. of 7-in. diameter pipes, and 10 ft. for suction lift. The guaranteed efficiency of the pump is 70 per cent., and of the motor 92½ per cent. A small sinking pump of the same type, capable of delivering 150 gallons per minute against a head of 210 ft., has been provided to deal with the dook water below the main lodgment. Mr. Clark, towards the close of his paper, mentioned that a motor-generator was being installed underground, capable of supplying power to 10 Jeffrey electric drills to be utilised for boring shot-holes in the shale.

Concrete Institute.—The Council has decided to offer a medal annually for the best paper submitted relating to concrete and its applications.

Electric Calculating Machines.—Dr. van der Borght, president of the German Imperial Statistical Board, has just returned to Berlin from New York, whither he proceeded to make an examination of electric calculating machinery in operation there and also in Washington. The journey was preceded by a similar visit to Vienna, Berne, Neuenburg, Paris and Christiania, in company of various officials of the Statistical Board and the Home Office for the purpose of inspecting the machines used in those cities. The machines comprise the three groups represented by electric numbering machinery, electric sorting machinery, and mechanical addition machines, and the efficiency and reliability of the machines are declared to be so high as to exceed by far those of human efforts. A large number of American railway and insurance companies have adopted these means for statistical purposes, and it is hinted that they might be introduced in Germany with great advantage.

Electro-Metallurgy in Switzerland.—It is announced by a Zurich newspaper that a group of important French and Swiss banks have opened a credit of £320,000 to a Société Electro-metallurgique Paul Girod, of Neuenburg, in order to render it possible for the undertaking to unify its current liabilities and extend its plant. The Franco-Swiss banking group which has turned attention to the Girod Co., is under the lead of the Société Marseillaise de Crédit Industriel et Commercial, which occupies itself specially with enterprises engaged in the metal industry. A French subsidiary of the Girod company—the Compagnie des Forges et Chantiers de la Méditeranée, of Ugine—was formed some time ago with a share capital of £160,000, which is held by the Swiss parent concern, and the company has been able to secure large orders from the French naval and military authorities.

Appointments Vacant.—Electrical engineer to take charge of Cambuslang electricity and refuse destructor works (£160); draughtsman to York electricity department (£2 2s.); resident engineer at Stoke-on-Trent (£180). See our advertisement pages to-day.

Educational.—Borough Polytechnic Institute.—The new term opens September 26th. Prospectus from the Principal. See our "Educational Notices" to-day.

The L.C.C. evening schools, technical institutes and schools of art re-open on Monday, 19th inst., and at the polytechnics on the 26th inst. Last year the number of evening students enrolled was about 170,000; the fees are almost nominal.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Bournemouth tramway staff have presented an 18-carat gold watch and chain to Mr. J. H. Chick, station engineer, who is leaving for Ceylon.

Mr. C. H. Yeaman, electrical engineer for the Potteries, entered upon his extended duties on September 1st. The *Staffordshire Sentinel* of September 2nd contains an account of Mr. Yeaman's career, accompanied by a photograph which is stated to represent him.

Mr. A. Harvey, of the South Metropolitan Electric Light and Power Co., Ltd., has been appointed assistant engineer to the Central Electric Supply Co., Ltd.

The electrical engineer of Burnley is to be paid an honorarium of £60 for services rendered in supervising the installation of electric lighting and apparatus at the Technical Institute.

Mr. Hubert Pooley, engineer and manager to the Corporation gas and electrical works at Stafford, has been selected for the appointment of manager of the Leicester gas and electric lighting undertaking.

The Bexley Heath U.D.C. on August 31st rejected a proposition "that the electrical engineer and manager be given three months' notice to terminate his appointment." The motion was the outcome of the recent dismissal of the charge engineer, to whom, it was stated, the manager had given an excellent testimonial.

Tramway Officials.—The marriage took place at All Saints' Church, Upper Norwood, on Saturday, of Mr. Wm. Eversley Hardy, manager and engineer of the Bath Electric Tramways, Ltd., and Miss Gertrude May Boothby, daughter of the late Mr. Lawrence J. Boothby, of Teddington, and of Mrs. Penn, of Holmwood, South Norwood Hill. The presents included a silver salver from the directors of the Bath Electric Tramways, Ltd.

On the occasion of his marriage, on September 7th, Mr. Herbert Jackson, of the Manchester Tramway staff, was presented by the traffic department staff with an oak clock, and by the Tramway Employés' Athletic Society, of which he is the hon. sec., with a bookcase and bureau.

At a meeting of the Manchester City Council on Wednesday, it was agreed by a substantial majority to advance the salary of the general manager of the tramways, Mr. J. M. M'Elroy, from £1,000, by annual increments of £50, until £1,250 is reached, he agreeing to remain for five years on these terms.

General.—According to the *Daily Telegraph*, Sir J. J. Thomson, F.R.S., who, with Prof. Ernest Rutherford, of Manchester University, was to have represented his Majesty's Government at the International Congress of Radiology and Electricity, which opened at Brussels on Tuesday, was, through private business, unable to accompany his colleague. Prof. Rutherford is, therefore, acting alone as delegate for Great Britain.

Mr. J. Mooney has been co-opted a director of the Dublin United Tramways Co., in place of the late Mr. William Anderson. The board will not appoint any managing director.

Mr. A. W. Empson, A.M.I.E.E., A.M.I.Mech.E., general manager of the Cast-Iron Brazing Syndicate, Calcutta, is paying a short visit to England on business, and is expected to arrive in London on September 19th. Any communications for him should be addressed c/o Messrs. Keymer, Son & Co., 1, Whitefriars Street, London, E.C.

We regret to learn that Mr. Walter T. Le Feuvre, borough electrical engineer, Bexhill, met with a serious accident on Friday last—breaking his ankle whilst undergoing special training at Chatham in connection with the Territorial Army.

Messrs. Preece & Cardew announce that Messrs. J. F. C. Snell and S. S. Moore Ede will join them in partnership on October 1st. Mr. J. H. Woodward, who has been upon their staff for the past 12 years, will also become a partner. The partners will be Sir W. H. Preece, K.C.B., F.R.S., &c., A. H. Preece, M.I.C.E., &c., J. F. C. Snell, M.I.C.E., &c., Llewellyn Preece, M.I.C.E., &c., J. H. Woodward, A.M.I.C.E., &c., and S. S. Moore Ede, A.M.I.C.E. The name of the new firm will be Preece, Cardew & Snell, and the office will remain at No. 8, Queen Anne's Gate, S.W. Messrs. Snell & Moore Ede ask that all communications for them should be sent to the above address after September 30th.

Obituary.—Mr. V. A. H. M'Cowen.—A very large number of our readers, particularly those connected with electricity supply work, and manufacturers and contractors who are directly interested therein, will learn with deep grief of the very early death of Mr. V. A. H. M'Cowen, formerly city electrical engineer of Belfast, and for the past few years chief in a similar capacity at Salford until a few months ago, when failing health compelled him to relinquish that office. Mr. M'Cowen, who was an M.I.E.E., and M.I.Mech.E., was born at Tralee, Co. Kerry, in 1866, and educated in Dublin. He spent about eight years at mechanical engineering, and afterwards took a two years' course in electrical engineering at Finsbury Technical College, under Prof. Thompson, obtaining the College Certificate, also a Goldsmiths' Company's Prize and Institute Medal for "Electric Lighting." After some practical experience in dynamo manufacture and installation work, he joined the engineering staff of Messrs. J. E. H. Gordon & Co., London, and was employed on the design and erection of several electric supply schemes carried out by this firm, and acted as engineer-in-charge in the Sydenham District Electric Supply Co.'s Works—the first high-tension continuous-current station with rotary transformers, running in the United Kingdom. In 1892 he was appointed consulting and resident engineer to the Killarney Electric Light Co., with whom he remained for two years, when he designed and carried out their water-power high-tension alternating-current scheme for the supply of electrical energy in the district. In 1894 Mr. M'Cowen was appointed City electrical engineer of Belfast, and superintended the erection of the original gas-engine scheme under Prof. Kennedy. From the completion of the same in 1895, until his resignation in 1907, he acted as the Council's consulting engineer. He designed and carried out the existing scheme arranged for lighting and traction. He has also acted as consulting engineer to the Urban District Council of Ballymena and other public bodies. In March, 1907, he was appointed borough electrical engineer of Salford. Within 12 months of this appointment he had the misfortune to lose his wife, who died on February 23rd, 1908. He felt this loss very keenly, and shortly afterwards became ill, suffering from neuritis, which speedily developed into sarcoma of the spine. After being away from business for short periods, he left Manchester to take up residence in a Medical Home at Bath in July last year, and died there on the 8th inst. Owing to continued ill-health he resigned his position as electrical engineer to the County Borough of Salford; his resignation was accepted with great regret on April 25th, 1910, and Mr. Herbert J. Hawkins was appointed borough electrical engineer. The interment took place at Kersal, Manchester. The deceased gentleman leaves a family of two girls and one boy.

At Monday's meeting of the Belfast Corporation, the death of Mr. M'Cowen was referred to with deep regret. Ald. Finnigan, in moving a resolution of sympathy with the relatives of Mr. M'Cowen, said their late electrical engineer was a thorough gentleman in all his ways, and when Belfast lost his services Salford made a great gain. From several reasons, first of all the death of his wife, and then the extreme pressure of work in consequence of the rearrangement of the Salford station, his health broke down, and his friends, who knew and appreciated his worth, mourned his early demise. Councillor Irvine seconded the resolution, which was passed in silence, the members of the Council standing.

William Finlay, junior.—We deeply regret to record the death of Mr. Wm. Finlay, jun., of Edinburgh, who was last year president of the Electrical Contractors' Association (Inc.). Mr. Finlay passed away on the evening of Wednesday, 7th inst., at the residence of his father in Edinburgh. The cause of death was a block of one of the arteries in the brain, which caused heart failure 26 hours after the first symptoms appeared. The deceased gentleman was only 38 years of age, and leaves a widow and family, to whom the hearts of all who knew him will go out in sympathy. The funeral took place on Monday last.

CITY NOTES.

Vera Cruz Electric Light, Power and Traction, Ltd.

Mr. Vincent W. Yorke presided at the third ordinary meeting held on August 31st at 47, Palmerston Street, E.C. In moving the adoption of the report (see Electrical Review, September 9th), he said that there had been a considerable increase in the business. This, with the satisfactory saving effected in the costs of operation by the good results obtained from the oil-engine plant, had resulted in the net profits showing an increase of nearly 100 per cent. over those recorded for the year 1908. This improvement in the business was to be found in all three departments, power, lighting and tramways, and during the first six months of the present year they could record still further increases in gross and net profits. The monthly earnings published during the present year showed a satisfactory increase over the results for the corresponding period of 1909. He had just returned from a visit to Mexico, and expressed complete satisfaction with the condition of the properties of the company and with the local management. The outlook for the future was very hopeful. They had just completed the installation of additional arc lamps for the city, and the business which was in sight, and should be connected before the end of the year, would enable the company to show a satisfactory increase in the profits for the current year, as compared with those of 1909. The old issue of 6 per cent. debentures was redeemed, and a fresh issue was made of 5 per cent. debenture bonds. The holders of these bonds in March last made a public issue, which was entirely successful.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Montreal Water and Power Co.—Further issue of £50,000 4½ per cent. first mortgage prior lien gold bonds of £100 each (Nos. 5,773 to 6,272).

Vera Cruz Electric Light, Power and Traction, Ltd.—£350,000 5 per cent. first mortgage debentures (Nos. A1 to A2,300 of £100, and B1 to B1,000 of £20 each), in lieu of the scrip.

Winnipeg Electric Railway Co.—Further issue of £200,000 4½ per cent. perpetual consolidated debenture stock.

The Committee has ordered the undermentioned to be quoted in the Official List:—

London Electric Railway Co.—£3,150,000 4 per cent. preference stock, and £3,791,106 4 per cent. debenture stock, in lieu of the securities of the Baker Street and Waterloo Railway, Charing Cross, Euston and Hampstead Railway, and the Great Northern, Piccadilly and Brompton Railway.

Metropolitan District Railway—Further issue of £186,433 Metropolitan District guaranteed stock (4 per cent.).

Shawinigan Water and Power Co.—The President announces that as from the commencement of next year the dividend will be raised to 5 per cent., as against 4 per cent. paid hitherto. The *Financial Times* states that it is proposed to issue $500,000 new shares at par to the existing proprietors. "The latest reports concerning the progress of business are very encouraging, and with the expansion anticipated in the scope of the company's operations during the next few years an increased degree of prosperity is looked for. The feature of the company's working is the extremely low ratio of its operating charges resulting from the circumstance that its plant is situated in the centre of the district to which it supplies electrical energy, while the fact that the power is sold in bulk instead of in retail quantities also leads to economies in working. Most of the hydro-electric power companies have had to lay and maintain several hundred miles of distributing mains, the cost of which is not only heavy in the first place, but is considerable at all times in respect of maintenance charges."

Yorkshire Electric Power Co.

Mr. A. G. Lupton presided on Tuesday last week at the half-yearly meeting held at Leeds. In moving the adoption of the report (see Electrical Review, September 2nd), he referred to the steady and satisfactory advance that the company had made. In two years the total receipts for the six months had increased from £8,698 to £16,675, and the gross profit had grown from £1,249 to £4,950. It was to this increasing ratio of profit to revenue that they looked for putting the company on a dividend-paying basis. At the February meeting it was reported that an overhead main in duplicate was under erection to Castleford, in the eastern portion of the company's area. Supply had now been given for several months to a large colliery in that district, which was using it for hauling, pumping, ventilating, lighting, &c. Negotiations were proceeding with colliery proprietors both in this and other portions of the company's area, and they anticipated a largely increased demand for these purposes in the near future. The Castleford line was also finding a number of other customers anxious for supply. An overhead line was at present being carried to the western portion of the company's area from Brighouse to Sowerby Bridge, where the Distribution Co. was being pressed for a supply, and where some important contracts had already been made, including a considerable supply to a large cotton mill now being built there. A further extension was also being proceeded with in the vicinity of Barnsley, where a large colliery would shortly be taking energy. During the half-year further connections had been made to the mains laid or erected before the present year. In the case of a large mill in the Dewsbury district, owing to the total collapse of one of the main mill engines, the company was called upon for an emergency supply. The damage was so considerable that many months would have elapsed before the engine could have been repaired or renewed, but a partial supply was got going within a few hours, some hundreds of horse-power of motors were connected, and the whole mill was running as before in less than a fortnight, greatly to the relief of both employers and employed.

The matter of the proposed issue of preference shares was dealt with at the extraordinary meeting, which followed immediately. A resolution was there passed approving the creation of 20,000 6 per cent. preference shares of £5 each. The seconder of this resolution said that the company had not only turned the corner, but it had a straight road in front of it, and with the help of the new shares, they would go along at a great pace.

Puebla Tramway Light and Power Co.—The report states that the results for the year 1909 show a considerable improvement over those of the previous year, the net profits in Mexico having been £48,677, as against £27,354 for 1908, or an increase of about 78 per cent. Since the acquisition of the San Augustin Co. referred to in the report for 1908 (says the *Financier*) the increase in revenue in the lighting section has been satisfactory, and the board anticipate a further increase as the old lighting contracts expire and renewals are effected at the new rates now being charged by the company, although these rates are still much below the prices obtained before the competition with the San Augustin Co. The power business has also shown an increase in gross and net earnings. The tramways receipts, on the other hand, have shown no expansion during the year. For the six months to June 30th, the net earnings in Mexico have been approximately £26,000, and the bond interest is, therefore, now more than covered. The improvement shown for the period under review would have been still more marked were it not for the depression in the cotton industry, which has in particular affected the industrial tramway earnings, and has also hindered the power business from increasing at a greater rate. With the revival in trade now anticipated, the board are satisfied that the outlook for the future is assured, and that a continued steady increase in the revenue may be anticipated. The development of the Tuxpango Falls has not yet been commenced, but it cannot be longer delayed. The growing demands of the city of Puebla, the absorption of the power the company has at present available, and the terms of the company's concession from the city of Puebla make it essential that 15,000 H.P. should be available for sale within the city boundaries by 1913.

Direct Spanish Telegraph Co., Ltd.—The board have decided to pay, in addition to the dividend at the rate of 10 per cent. per annum on the preference shares, an interim dividend at the rate of 4 per cent. per annum, free of income-tax, on the ordinary shares, both for the half-year ended June 30th, 1910, and payable on October 1st.

Dundee, Broughty Ferry and District Tramway Co.—For the first time since the company was formed the holders of ordinary shares are this year to be paid a dividend. Savings have been effected in the management—an annual payment in this connection having ceased after three years—and although the drawings have, on account of the bad weather, fallen by £200 as compared with the previous year, about £1,200 is to be set aside for renewals. A dividend of 2 per cent. will be paid to ordinary shareholders, and, as usual, 6 per cent. will be paid on the preference shares.

Bromley (Kent) Electric Light and Power Co., Ltd.—The directors have declared an interim dividend at the rate of 4 per cent. per annum (2s. per share) on the ordinary shares for the past half-year.

German Electrical Companies.

The shareholders in the Mix & Genest Co., of Schoneberg-Berlin, recently approved the report and accounts for 1909-10, and the payment of a dividend of 3 per cent., as compared with no distribution in the preceding year. Notwithstanding the continuance of the unfavourable situation of trade, the report stated that the more satisfactory results were due to improvements in the organisation and manufacture and to economies effected in the management, and similar causes had tended to increase the proceeds in the case of the branches and subsidiary companies. The gross surplus amounted to £64,900, as against £65,000 in 1908-9. After deducting working expenses and interest charges, and appropriating £17,400 for depreciation, as contrasted with £17,200 in the previous year, the net profits and balance forward were £20,000, as compared with £6,500 in 1908-9. It was mentioned at the meeting that new branches had been taken up—such as railway signalling, electric clocks and tachometers, and the galvanising of aluminium.

The Hartmann & Braun Co., of Frankfort-on-Main, according to the directors' report for 1909, experienced the hampering influence upon the sales of measuring instruments that had been undergone in previous periods of economic depression. But the possibility of sales was prejudiced to a still greater degree owing to the energetic participation of the large firms in the market for specialities, which they formerly only produced mostly for their own requirements. The unlimited cutting of prices in this direction was quite incomprehensible, whilst wages and salaries in particular, and other expenses, constantly increased. In these circumstances the turnover declined, and the net profits receded in a totally incomparable manner. The orders received in the final months of the year and in the first quarter of 1910 increased, and the indications held out the prospect of a lasting advance. These expectations, it was mentioned at the annual meeting, had been justified, and the outlook was somewhat more favourable. After appropriating £6,800 for depreciation in 1909, as against £6,400 in the preceding year, the net profits and balance forward amounted to £15,100, as compared with £25,600. The balance has allowed of the payment of a dividend of 8 per cent., as contrasted with 11 per cent. in 1908 and 12 per cent. in each of the two preceding years on a share capital of £85,000.

The directors of Brown, Boveri & Co., of Mannheim, in the course of their report for 1909-10, state that the results did not fulfil the hopes which were expressed a year ago. If the impression was created at the beginning of the financial year that the course of business would revive, prices remained later on in general at the low level, and even further receded in the case of steam turbines. At the same time the increased competition, and the growing demand of customers, rendered necessary a considerable augmentation in the home and foreign staff. These circumstances did not permit, on the one hand, the working profits to advance in proportion to the turnover, and on the other, caused the working expenses to largely increase, the result being a considerable decline in the net profits. After referring to the development of the turbine department, the report observes that the paper industry occupied a prominent place in the trades for which the company delivered complete installations. Various railway plants for industrial purposes on the single-phase system were carried out and set in operation during the year. An order for an electric goods locomotive of 600 H.P. was received from the Prussian State Railway Authorities for the Magdeburg-Halle section, so that the company was interested in the two principal main line schemes in Germany, the other being the Wiesenthal Railway. The manufacture of small and medium-sized motors had been rationally improved and extended in order to bring the prime costs into a more favourable relation to sale prices. The accounts show the following figures for the two years :—

	1909-10.	1908-9.
Share capital (paid)	£300,000	£300,000
Bond capital	225,000	225,000
Gross profits	128,300	122,600
Depreciation provision	19,700	18,500
Net profits and balance forward	17,000	26,200
Dividend, per cent.	4	6

The report also refers to the companies in which the Mannheim undertaking is interested, including the Turbinia and the Howaldt shipbuilding yard. It is added that a certain revival took place at the end of the financial year, and the first quarter of the new year shows an increase of 15 per cent. in the turnover, as contrasted with the corresponding period in 1909.

Manila Electric Railroad and Lighting Corporation, Ltd.—It is announced that a dividend of 1 per cent. for the quarter ending September 30th has been declared on the total issue of $5,000,000 common stock.

Sao Paulo Tram, Light and Power Co., Ltd.—The directors have declared a quarterly dividend of 2½ per cent. on the capital stock, payable on October 1st.

Oklahoma Gas and Electric Co.—The directors have declared a quarterly dividend of 2 per cent. on the common stock.

Muskogee Gas and Electric Co.—The directors have declared a quarterly dividend of 1¾ per cent. on the preferred stock.

San Diego Gas and Electric Co.—The directors have declared a quarterly dividend of 1¾ per cent. on the common stock.

MARKET QUOTATIONS.

Wednesday, September 14th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.	5/-	..
a „ Nitric .. .. .. „	22/-	..
a „ Oxalic .. .. .. „	28/-	..
a „ Sulphuric .. .. .. „	5/6	..
a Ammoniac, Sal .. .. .. „	42/-	..
a Ammonia, Muriate (crystal) .. per ton	£29	..
a „ „ .. .. .. „	£30	..
a Bleaching powder .. .. .. „	£5 10	..
a Bisulphide of Carbon .. .. „	£18	..
a Borax .. .. „	£16	..
a Ferro-Silicon (50 %) .. .. „	£9 10	..
a Copper Sulphate .. .. .. „	£18	..
a Lead, Nitrate .. .. .. „	£25	..
a „ White Sugar .. .. „	£23 10	..
a „ Peroxide .. .. .. „	£32	..
a Methylated Spirit .. .. per gal.	2/6	..
a Potassium, Bichromate, in casks per lb.	8½d.	..
a Potash, Caustic (75/80 %) .. per ton	£20	..
a „ Chlorate .. .. .. per lb.	8½d.	..
a „ Perchlorate .. .. „	4½d.	..
a Potassium, Cyanide .. .. „	7d.	..
a Shellac .. .. per cwt.	88/-	..
a Sulphate of Magnesia .. .. per ton	£4 10	..
a Sulphur, Sublimed Flowers .. „	£6 10	..
a „ Recovered .. .. „	£5 10	..
a „ Lump .. .. .. „	£5	..
a Soda, Caustic (white 70 %) .. „	£11	..
a „ Chlorate .. .. .. per lb.	2½d.	..
a „ Crystals .. .. .. per ton	£3 5	..
a Sodium Bichromate, casks .. per lb.	3d.	..
a „ Cyanide (basis 100 %) .. „	7d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. per ton	£80	..
b „ Wire, in ton lots .. „	£112	..
b „ Sheet, in ton lots .. „	£120	..
p Babbitt's metal ingots .. .. „	£38 to £145	..
c Brass (rolled metal 2" to 12" basis) per lb.	6½d.	..
c „ Tube (brazed) .. .. „	8½d.	..
c „ „ (solid drawn) .. „	7d.	..
c „ Wire, basis .. .. .. „	6½d.	..
c Copper Tubes (brazed) .. .. „	9d.	..
c „ „ (solid drawn .. „	8½d.	..
g „ Bars (best selected) .. per ton	£71	..
g „ Sheet .. .. .. „	£71	..
g „ Rod .. .. „	£71	..
e „ (Electrolytic) Bars .. „	£58 10	..
e „ „ Sheets .. „	£74 15	..
e „ „ Rod .. „	£63 5	..
e „ „ H.C. Wire per lb.	7¾d.	..
f Ebonite Rod .. .. .. „	6/-	..
f „ Sheet .. .. .. „	5/6	..
n German Silver Wire .. .. „	1/6	..
h Gutta-percha, fine .. .. „	..	..
h India-rubber, Para fine .. .. „	7/7	9d. dec.
l Iron Pig (Cleveland warrants) .. per ton	49/10½	8½d. inc.
l „ Wire, galv. No. 8, P.O. qual. „	£14	..
g Lead, English Ingot .. .. „	£12 15 to £12 17 6	..
m Manganin Wire No. 28 .. .. per lb.	6/6	..
g Mercury .. .. .. per bot.	£8 12 6	..
d Mica (in original cases) small .. per lb.	6d. to 1s.	..
d „ „ „ medium „	2/6 to 4/-	..
d „ „ „ large .. „	4/6 to 8/6	..
p Phosphor Bronze, plain castings „	11d.	..
p „ „ rolled bars & rods „	1/0½	..
p „ „ rolled strip & sheet „	1/1	..
o Platinum .. .. per oz.	190/-	..
e Silicium Bronze Wire .. .. per lb.	8½d.	..
r Steel Magnet, in bars .. .. per ton	£55	..
g Tin, Block (English) .. .. „	£156 to £157	£2 dec.
n „ Wire, Nos. 1 to 16 .. .. per lb.	1/10	..
p White Anti-friction Metals .. per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.) „	£27 10	5/- inc.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

United Electric Car Co., Ltd., Preston.—The directors' report for the year ending June 30th, 1910, states that the works have been efficiently maintained as regards buildings and machinery, the cost of which has been charged against revenue. After paying debenture interest amounting to £2,475, and charging £5,587 for depreciation, the profit for the year is £8,478, to which is added £5,333 brought forward from last year, making a total of £13,812, less the preference dividend for the six months ending December 31st, 1909, £3,000, leaving an available balance of £10,812. It is proposed to pay the preference dividend, less income-tax, for the half-year ending June 30th, 1910, £3,000; a dividend of 2½ per cent., less income-tax, on the ordinary shares for the year ending June 30th, 1910, £3,750; and to carry forward to next year, £4,062.

South Metropolitan Electric Light and Power Co., Ltd.—The debenture stock register and register of transfers will be closed from September 17th to 30th, for preparation of warrants for interest on the 4½ per cent. first mortgage debenture stock for the half-year ended October 1st.

STOCKS AND SHARES.

Tuesday Afternoon.

The labour situation occupies the most dominant position in the investment markets of the Stock Exchange. Whatever may be the outcome of the dispute in the boilermakers' trade, the Great Northern Railway and the cotton trade ranks, the result cannot escape having regrettable—if not deplorable—effects upon investment in domestic securities. Capital will be turned more and more to foreign channels for its employment, and the investor grows increasingly chary of using his cash for the stocks and shares of companies operating at home.

To those who are not fully conversant with its history for the past half decade, the dryness of the electricity supply market might seem an excellent moral with which to point the preceding tale. But, of course, labour troubles have no direct bearing upon these electrical shares, which are under a heavy cloud of various shades, ranging from greyness to solid black. This week there is no solitary change to chronicle in the catalogue of home companies, but it is not to be inferred thereby that energy or enterprise is lacking. The able letter written to the papers by Mr. H. B. Renwick, Chairman of the Electric Supply Publicity Committee, should go far to dissipate whatever unfortunate—from the point of view of electricity—impression might have been provoked by the change of illumination in a few of the West End streets. Mr. Renwick treats the matter with a breadth of argument, supported by facts, that convincingly shows how electricity lights nearly the whole of the London districts, and his dispassionate figures speak with greater eloquence than would a couple of columns of special pleading.

While the market for lighting shares slumbers, the traction descriptions are unmistakeably awake. It is rather a curious thing how, during the past week or two, prices have risen very appreciably of shares in tramway and power companies in different parts of the world. A short table showing how widespread has been the movement, may be of interest. We take the end of August as a starting point:—

Stock or share.	Aug. 22.	Sept. 13.	Rise.
Anglo-Argentine Second Pref.	4¼	4⅜	⅛
Bombay Elec. Sup. and Tram. Pref.	10½	11	½
British Columbia 5 per cent. Pref.	111	112½	1½
Calcutta	4¼	4⅜	⅛
Cape Electric	⅜	⅜	..
Metropolitan Electric Pref.	⅝	⅝	..
Mexico	120	128½	8½
Para	6⅛	6⅜	⅛
Perth	¾	¾	..
Rio de Janeiro	94	100¼	6¼
Sao Paulo	145	157	12

From South America to Western Australia, from the Cape of Good Hope to India, and from London to Mexico, Vancouver and Brazil, the rise is spread. The market, limited as it is in the ordinary way, can claim to have been one of the best in the Stock Exchange for the past month; while, in the present week, Mexico Trams and Rio Trams stand out as predominantly strong. The advance in Mexico Trams has swept the Mexican Lighting issues into its train. Mexican Light and Power Common stock rose 3, Mexican Electric Light bonds 2. The Shawinigan Power Company announces an increase from 4 per cent. to 5 per cent. in the dividend on its capital stock, coupling the declaration with the news that a further issue is about to be made at par. The current price of the existing stock is 104, which includes 1¼ per cent. of the dividend just declared, so there is no great "turn" involved in the new emission.

Canadian General Common stock at 112 is 5 points higher than it was three weeks ago, yet the 7 per cent. Cumulative Preference at 121½ is 2 points lower, although the present quotation is full of the six months' dividend. Another bond on which the interest falls due very shortly is that of the Northern Light, Power and Coal Co. The bonds bear 5 per cent. interest, payable early in November, and the price is 85.

Fluctations have been sharp in the Home Railway market, and a severe fall in prices last Saturday was followed by a general recovery on Monday in this week. Metropolitan Consolidated, however, fell a point, which it failed to regain, but Districts regained ¼ drop. Central London Ordinary lost 1, the other electrical railway stocks being unchanged. British Electric Traction Debenture stocks gained a point apiece. London United Trams are unaltered. Underground Electric Railway bonds pursue their steady rise, which has spread to the 6 per cent. Incomes, and these, as a lock-up speculation, might suit some who do not mind foregoing present dividends in the hope of making a good profit on their capital in the future.

Another long list of rises in the telegraph and telephone section reflects the increasing power, and purchases, of the real investor. The special feature this week has been the substantial rises in West India and Panama Telegraph shares. Even the Ordinary, which are of £10 each and fully-paid, have enjoyed a good advance, while the Second Preference rose half-a-sovereign, the idea being that the company is doing so well that plenty of scope for a further rise still exists. Other telegraphs, too, are good. American Telephone and Telegraph eased off, and Marconi's are a little easier.

Industrials keep very steady, as a whole, and the labour troubles have so far made little difference to the prices in this section.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations Sep. 6th.	Closing Quotations Sep. 13th.	Business done week ended Sep. 13th, 1910. Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
		*										£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	3⅛ — 4	3⅛ — 4	..	..	..	Nil.
286,500	Do. 5 % Deb. Red. 1ss. at 98 % script all paid	Stock	5 %	5 %	5 %	5 %	95 — 97	95 — 97	..	..	..	4 17 7
255,196,000	American Telephone & Telegraph, Cap Stock ..	$100	8 %	8 %	8 %	8 %	139 —142	138 —141	..	..	—1	5 13 6
53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	93 — 95	93 — 95	..	..	..	4 4 3
558,460	Anglo-American Telegraph	Stock	3⅞%	3⅛%	£3 4s.	3⅛%	68 — 70	67½ — 69½	68½	67½	— ½	5 4 4
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	110 —112	110 —112	110⅝	110	..	5 7 2
3,220,770	Do. do. do. Deferred	Stock	1⅜%	1 %	8/-	25/-	27⅞ — 28⅛	27¼ — 27½	27½	27⅛	— ⅜	4 10 11
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	100½ — 102½ xd	101 —103	..	..	+ ½	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	9¼ — 9⅝	9⅛ — 9⅝	..	..	+ ⅛	4 1 0
2,449,176	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	84 — 86	84½ — 86⅝	85½	85¼	+ ½	4 12 6
16,000	Cuba Telegraph	10	5 %	6 %	6 %	6 %	8⅜ — 9½	8⅝ — 9⅝	..	..	+ ⅛	6 8 0
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16⅝ — 17⅝	16⅞ — 17½	..	..	+ ⅛	5 14 3
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3⅛ — 3⅜	3 1/16 — 3 1/8	..	..	+ 1/16	5 3 3
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8 — 8½	8¼ — 8⅝	..	..	+ ⅛	5 14 3
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —102	100 —102½	..	..	+ ⅜	4 7 10
60,710‡	Direct United States Cable	20	4½%	4½%	4½%	4 %	15⅝ — 16⅛	16 — 16⅛	16⅛	16	+ ¼	4 17 0
36,000	Direct W. India Cable, 4½% Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99 —101	99½ —101½	..	..	+ ½	4 8 8
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	132½ —135½	133 —136	134½	133½	+ ½	5 2 11
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	84 — 86	84 — 86	84½	..	..	4 1 5
1,896,706	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	4 %	102½ — 104½	102½ —104½	104	..	..	3 16 7
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	12⅝ — 13⅛	12⅞ — 13⅛	13	12⅝	+ ⅛	5 5 8
752,400	Do. 4 % Deb. Stock..	Stock	4 %	4 %	4 %	4 %	100 —102	100 —102	101¼	100½	..	3 18 5
200,000‡	East. & S. Afric. Tel., 4 % Mt. Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	100	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5⅛%	5⅞%	5⅝%	5⅞%	10⅛ — 11	10⅛ — 11	10⅝	10⅜	..	5 6 6
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	13 — 13½	13⅜ — 13⅝	13 1/16	13¼	+ ⅛	4 7 3
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	20 %	20 %	18 %	..	30 — 31	30 — 31	..	..	..	5 18 6
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	53 — 55	53 — 55	54⅜	54½	..	6 15 8
$41,380,400	Mackay Companies Common	$100	3⅛%	4 %	4 %	4⅛%	86 — 89	86 — 90	..	..	..	4 14 5
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	74 — 78	74 — 78	..	..	..	5 2 7
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	25/32 — 29/32	3/4 — 7/8	16/6	..	—1/32	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	6 %	29/32 — 31/32	29/32 — 31/32	..	..	..	6 4 8
86,492	Do. do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	27/32 — 29/32	27/32 — 31/32	..	..	..	5 3 11
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	104 —105½	104½ —106	105	104½	+ ½	5 13 2
3,725,000	Do. do. Def. Stock	100	5 %	6 %	6 %	6 %	123 —125	123 —125	123½	123	..	4 16 0
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	..	..	..	5 11 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	5 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	..	..	..	5 11 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ — 5⅝	..	..	..	4 10 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	99 —100	98 —100	..	..	— ½	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red... ..	100	4 %	4 %	4 %	4 %	99 —101	99 —101	99½	..	..	3 19 3
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid..	1	7 %	8 %	8 %	8 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	4 18 6
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	6 %	1¼ — 1⅜	1¼ — 1⅜	..	..	..	4 7 3
195,955	Do. do. do. 4 % Red. Deb. Stock..	100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	..	..	..	4 10 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	97 — 99	97⅛ — 99½	..	..	+ ½	4 0 5
11,839	Reuter's	8	5 %	5 %	5 %	5 %	7⅝ — 8⅛	7⅝ — 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	98½ —100½	98½ —100⅝	..	..	..	4 9 7
3,042	Submarine Cables Trust..	Cert.	6 %	6 %	6 %	..	132 —135	132 —135	..	..	..	4 8 11
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	7 3/16 — 7 5/16	7⅛ — 7⅜	..	..	+ 1/16	5 8 6
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	5⅛	5 5/16	..	4 10 11
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	2½%	2½%	2½%	..	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	4 10 2
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	97 — 99	97⅜ — 99½	..	..	+ ⅛	4 0 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980 ..	10	7 %	7 %	7 %	7 %	13⅜ — 14½	13⅝ — 14¾	14⅛	13 1/16	..	4 18 3
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	100—102	100—102	..	..	..	3 18 5
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	1/32 — 3/32	1 3/32 — 1 1/32	23/9	18/11½	+ ½	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	8 %	6 %	6 %	6 %	8½ — 9	9 — 9⅛	9⅛	8 9/32	+ ⅛	6 6 4
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	£2 6	15 %	14⅜%	8⅛ — 9¼	8⅞ — 9¼	9⅛	8⅞	+ ⅛	15 0 0
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101—103	101⅛—103½	..	..	+ ⅛	4 16 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5% Cum. 1st Pref. 1 to 640,000	5	..	..	..	5 %	4 7/16 — 4 11/16	4¼ — 4⅜	92/6	90/-	+ 1/16	5 5 3
500,000	Do. 5 % 2nd Pref., 800,000 to 1,900,000	5	..	..	..	5 %	4 3/16 — 4 7/16	4¼ — 4½	..	..	+ 1/16	5 11 1
4,465,674	Do. 4 % Deb. Stock	Stock	..	..	4 %	4 %	91 — 92½	91½ — 93	92½	92⅛	+ ⅜	4 6 0
332,387	Auckland E. Trams, 5 % 1st Mort Deb. Stock ..	100	5 %	5 %	5 %	5 %	103 —105	103 —105	105	..	..	4 15 3
530,000	Babcock & Wilcox, 1 to 530,000	1	20 %	20 %	20 %	24 %	5⅛ — 5⅜	5⅜ — 5⅝	..	..	— 1/16	4 6 6
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 7/16 — 1 9/16	1 7/16 — 1 9/16	..	..	..	3 19 0
1,000,000	British Aluminium 5 % Mort. Debs. Red.	100	..	..	..	..	..	..	..	..	..	5 9 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	8 %	8 %	8 %	143 —147	143 —147	145½	143½	..	5 8 10
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	6 %	6 %	124 —128	124 —123	126	125	..	4 13 9
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	111 —114	111 —114	112½	111⅝	..	4 7 9
233,000	Do. 4½ % 1st Mort. Deb., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
133,301	British Electric Traction	10	Nil	Nil	Nil	Nil	⅜ — 1	⅜ — 1	15/-	12/6	+ 1/16	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	3 %	1½%	Nil	2⅝ — 3⅛	2⅜ — 3	52/6	..	— 1/16	Nil
1,473,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	88 — 92	89 — 93	..	..	+1	5 7 6
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	69 — 74	70 — 75	74½	..	+1	6 0 0
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	10 %	7 — 7⅛	7 — 7⅛	7 7/16	7⅛	..	6 13 4
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6 — 6⅛	6 — 6⅛	..	..	..	4 12 4
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
204,940‡	British Thomson-Houston 4½ % 1st Mort. Debs.	100	4½%	4½%	4½%	4½%	99 —101 xd	98 —101	102¼	..	— ½	4 9 1
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	Nil	1/16 — 2/16	1/16 — 2/16	..	..	..	Nil
1,316,353	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	61 — 63	61 — 63	..	..	..	6 7 0
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	9/16 — 11/16	9/16 — 11/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.. ..	2	Nil	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	37 — 42 xd	37 — 42	..	..	..	10 14 4
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	22 — 26	22 — 26	..	..	..	17 6 3
137,610	Calcutta Trams, 1 to 137,610	5	8 %	6 %	4½%	4½%	4⅛ — 4⅜	4⅛ — 5	..	..	+ ⅛	4 12 4
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,330..	5	5 %	5 %	5 %	5 %	4¼ — 5	4⅜ — 5	..	..	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
35,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	10 %	9⅛ — 9⅝	9⅛ — 9⅝	..	..	..	5 0 0
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	4⅝ — 5⅛	4⅝ — 5⅛	..	..	..	4 15 3
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	101 —103	101½—103½	..	..	+ ½	4 7 0
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	..	3/32 — 1/8	3/32 — 1/8	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	8 %	12 %	12½%	12½%	2 5/16 — 3	2 13/16 — 3 1/16	60/6	59/-	+ 1/16	4 8 4
210,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4 %	4½%	104 —107	104 —107	106	..	..	4 2 0
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	3 %	3½%	3 %	64 — 66	63 — 65	63	..	—1	4 12 4
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	84 — 86	84 — 86	..	..	..	4 13 0
554,655	Do. do. Def. do.	Stock	4 %	2 %	2½%	2 %	47 — 49	47 — 49	..	..	..	4 1 8
1,480,000	City and South London Railway	Stock	2⅜%	2⅜%	1¼%	1¾%	27⅛ — 28⅛	27⅝ — 28½	28¼	27⅞	..	6 2 10
85,000	Crompton & Co., Nos. 1 to 85,000	8	5 %	5 %	Nil	Nil	¼ — ⅜	¼ — ⅜	..	..	..	Nil
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 900 of £100, and 901 11,000 of £50 Red	..	5 %	5 %	5 %	5 %	83 — 85	83 — 86	..	..	..	5 17 8

* Unless otherwise stated, all shares are fully paid. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Sep. 6th.	Closing Quotations Sep. 13th.	Business done week ended Sep. 13th, 1910.		Rise + or Fall —	Present Yield per cent.
		*	1906.	1907.	1908.	1909.			Highest	Lowest		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	6 %	6 %	1 — 1⅛	1 — 1⅛	..	..	..	5 6 8
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 7/16 — 1 13/16	22/6	21/3	+ 1/16	5 1 1
271,080	Do. do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	98 —101	98 —101	..	..	..	4 9 1
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12⅜ — 13⅜	12⅜ — 13⅜	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	2½ %	2½ %	Nil	Nil	1/16 — 3/16	1/16 — 3/16	..	..	..	Nil
17,139	Do. "A" shares, 01—017,139	5	2½ %	2½ %	Nil	Nil	1/16 — 1⅛	1/16 — 1⅛	..	..	..	Nil
807,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	63 — 68	63 — 68	..	..	..	5 17 8
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	79 — 82	79 — 82	..	..	..	6 1 11
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	1/16 — 3/16	1/16 — 3/16	..	..	..	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	7 %	1⅛ — 1¼	1⅛ — 1¼	..	..	..	9 6 8
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	7⅞ — 8	7⅞ — 8	..	..	..	6 5 0
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	82 — 86	82 — 86	..	..	..	4 13 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	½ %	Nil	Nil	¾ — 1	¾ — 1	..	..	..	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10½ — 10⅝	10½ — 10⅝	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103½	..	..	..	4 16 10
40,000	Henley's (W.T.), Telegraph Works, Ord.	5	15 %	15 %	15 %	15 %	12 — 12⅜ xd	12 — 12⅜	12½	12 3/32	..	5 16 0
40,000	Do. do. 4½ % Pref.	5	4½ %	4½ %	4½ %	4½ %	4⅞ — 5⅛ xd	4⅞ — 5⅛	..	..	..	4 7 10
150,000	Do. do. 4½ % Mort. Deb Stock	Stock	4½ %	4½ %	4½ %	4½ %	106 —108	106 —108	..	..	..	4 3 4
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10 %	10 %	10 %	10 %	14½ — 15	14½ — 15	14⅞	..	..	6 13 4
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	½ %	Nil	Nil	13/16 — 15/16	13/16 — 15/16	..	..	+ ⅛	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	5 — 5½	5 — 5½	..	..	..	9 10 6
600,070	London United Trams. (1901) 1 to 50,007	10	3 %	3 %	Nil	..	1¼ — 2¼	1⅛ — 2⅛	..	..	..	Nil
399,930	Do. do. 60,008 to 100,000	10	3 %	3 %	Nil	..	1¼ — 2¼	1⅛ — 2⅛	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	3¾ %	..	2 — 2¼	2 — 2⅛	..	..	..	15 0 0
1,649,930	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	67 — 71	67 — 71	70½	67½	..	5 12 8
5,722,062	Metropolitan Consolidated	100	1 %	½ %	½ %	1 %	38¾ — 39¼	37⅞ — 38¼	38⅝	38½	—1	3 5 4
2,640,914	Do. Surplus Lands	100	2½ %	2½ %	2½ %	2½ %	65 —67	65 — 67	66½	..	..	4 2 1
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	21⅛ — 21⅜	21⅛ — 21⅜	21⅝	21¼	..	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	4½ %	5%	1/16 — 1/8	3/16 — 1/4	..	..	+ 1/32	5 17 8
314,016	Do. do. Defd.	1	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	+ 1/32	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/16 — 1/8	1/16 — 1/8	17/-	16/6	+ 1/16	5 6 8
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½ %	4½ %	4½ %	4½ %	96 — 99	96 — 99	97⅜	97½	..	4 10 11
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	6 %	122½ —124½	127⅝ —129½	128⅝	123⅝	+ 5	4 12 8
$9,000,000	Do. 1st Mort. 50-year 5 % Gld. Bds.	..	..	..	5 %	5 %	97½ —98½ xd	97⅝ — 98½	98⅝	97⅝	+ ½	5 1 6
245,500	Potteries Electric Traction	1	4 %	4 %	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	3/16 — 1/4	3/16 — 1/4	..	..	..	6 17 11
245,000	Do. do. Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	82 — 86	82 — 85	..	..	..	5 3 6
37,350	Telegraph Construction and Maintenance	12	15 %	17½ %	15 %	17½ %	34½ — 36½	35 — 37	35¾	35½	+ ½	5 13 10
140,000†	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100½ —102½	100½ — 102½	..	..	..	3 18 1
1,000,000	Underground Electric Railway, 5 % Prior Lien	..	..	..	5 %	..	103 —104	103 —104	103⅝	103⅜	..	4 16 2
2,800,000	Do. do. 4½ % Bonds	..	..	..	4½ %	4½ %	92 — 94	93 — 95	94½	93	+1	4 14 9
4,900,000	Do. do. 6 % Income Bonds	..	..	..	..	..	30 — 41	38 — 40	39½	38½	—1	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	Nil	10 %	5 %	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	..	6 %	6 %	3 %	1½ — 1⅝	1½ — 1⅝	..	..	..	8 11 5
245,495	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	60 — 70	60 — 70	..	..	..	5 14 4

ELECTRICITY SUPPLY COMPANIES.

30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10%	10 %	10 %	10 %	6⅞ — 7⅛	6⅞ — 7⅛	7⅛	..	..	6 15 7
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6⅝ — 7⅛	6⅝ — 7⅛	..	..	..	4 14 11
400,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3⅜ — 3⅞	3⅜ — 3⅞	70/-	..	..	6 9 0
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½ %	4½ %	4½ %	4½ %	4¼ — 4⅜	4¼ — 4⅜	..	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½ %	4½ %	4½ %	4½ %	3⅜ — 4¼	3⅜ — 4¼	..	..	..	4 17 0
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	97 — 99	97 — 99	104½	..	..	4 2 6
49,436	Chelsea Electricity Supply, Ord.	5	4½ %	4½ %	4½ %	4½ %	3⅜ — 4¼	3⅜ — 4¼	..	..	..	5 5 11
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½ %	4½ %	4½ %	4½ %	99 —101	99 —101	..	..	..	4 9 1
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	7 %	11⅛ — 11⅝	11⅛ — 11⅝	11¼	11	..	6 0 5
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11⅛ — 12¼	11⅛ — 12¼	..	..	..	4 19 0
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	120 —124	120 —124	..	..	..	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk.	100	4½ %	4½ %	4½ %	4½ %	99½ —102½	99½ —102½	..	..	..	4 7 10
50,000	County of Durham Electrical Power, Ord.	5	4 %	2 %	Nil	Nil	1⅛ — 2	1⅛ — 2	..	..	..	Nil
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	2⅝ — 3¼	2⅝ — 3¼	..	..	..	7 13 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	5 %	5 %	94½ — 96½	94½ — 96½	..	..	..	5 3 8
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝ — 7⅞	7⅝ — 7⅞	7 5/16	..	..	6 7 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10½ — 11	10½ — 11	..	..	..	5 9 1
400,000†	Do. do. 4½ % Deb. Stock	Stock	4½ %	4½ %	4½ %	4½ %	104½ —107½	104½ —107½	106½	..	..	4 3 9
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½ %	4½ %	4½ %	4½ %	100 —103	100 —103	102½	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	Nil	Nil	Nil	Nil	3/16 — 1/4	3/16 — 1/4	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	3 %	Nil	Nil	Nil	1½ — 2	1½ — 2	33/1½	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½ %	4½ %	4½ %	4½ %	75 — 78	75 — 78	..	..	..	5 15 5
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	5 %	5 %	82½ — 85½ xd	82½ — 85½	..	..	..	5 17 0
10,000	Folkestone, 1 to 10,000	5	5½ %	5½ %	5½ %	5½ %	4½ — 4⅝	4½ — 4⅝	..	..	..	5 15 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 10 11
90,000	Do. 4½ % 1st Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	99 —102	99 —102	..	..	..	4 8 3
15,000	Hove, 1 to 15,000	5	9 %	8½ %	8½ %	8½ %	7 — 7⅛	7 — 7⅛	7 5/16	..	..	5 13 4
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	..	5 %	5 %	100½ —102½	100½ —102½	102	..	..	4 17 7
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	8 %	8 %	6⅞ — 7⅛	6⅞ — 7⅛	7	..	..	5 10 4
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	93 — 95	93 — 95	..	..	..	4 4 8
11,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	2½ %	3 %	..	1⅝ — 2	1⅝ — 2	..	..	..	4 8 11
70,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	..	4 1/16 — 5⅛ xd	4 1/16 — 5 3/16	98/9	..	..	5 15 8
382,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½ %	4½ %	4 %	4 %	90 — 92	90 — 92	..	..	..	4 7 7
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8 %	6½ %	5 %	5 %	3¼ — 3⅜	3¼ — 3⅜	..	..	..	7 8 2
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½ %	4½ %	4½ %	4½ %	4 — 4⅛	4 — 4⅛	86/8	..	..	5 0 0
235,000	Do. 4½ % 1st Mort. Deben. Stock	Stock	4½ %	4½ %	4½ %	4½ %	102 —105	102 —105	..	..	..	4 5 9
248,000	Do. 3¾ % Mort. Deben. Stock Redem.	Stock	3¾ %	3¾ %	3¾ %	3¾ %	82 — 85	82 — 85	..	..	..	4 2 4
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	5 %	87 — 88	89 — 90	89½	87½	+ 1	5 11 1
13,585,000	Do. Light and Power Co., Ltd., Common	$100	..	4 %	3¾ %	4 %	84 — 86	87½ — 89½	89½	85	+ 3½	4 9 5
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	7 %	7 %	107½ —109½	108 —110	109½	108	+ 1	6 7 3
12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	..	5 %	5 %	93½ — 94½	94½ — 95½	94¾	93¾	+ ¾	5 5 0
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½ %	4½ %	4½ %	4½ %	95½ — 97½	95½ — 97½	..	..	..	4 12 4
180,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	2½ %	..	3⅝ — 4⅜	3⅝ — 4⅜	..	..	..	2 17 8
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4⅝ — 4⅞	4⅝ — 4⅞	..	..	..	5 2 7
150,000	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,500	100	..	..	..	5 %	100 —102	100 —102	..	..	..	4 18 0
10,852	Notting Hill Electric Lighting	10	7½ %	7½ %	7 %	..	12 — 13	12 — 13	..	..	..	5 7 8
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	7 %	6⅜ — 7⅛	6⅜ — 6⅞	6½	..	..	5 1 10
119,694	River Plate Elcty. Co. Ord.	Stock	2½ %	6 %	8 %	9 %	210—225	210—225	216	..	..	4 0 4
100,000	Do. do. 6% Non Cum. Pref.	Stock	6 %	6 %	6 %	6 %	105—115	105—115	..	..	..	5 4 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	100½—102½	100½—102½	..	..	..	4 17 7
40,000	St. James' and Pall Mall Electric Light, Ord.	5	10 %	10 %	10 %	10 %	7⅜ — 8¼	7⅜ — 8¼	7⅞	..	..	6 1 3
90,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	6¾ — 7¼	6¾ — 7¼	7½	..	..	4 16 7
150,000†	Do. do. 3½ % Deb. Stock Red.	100	3½ %	3½ %	3½ %	3½ %	84 — 86	84 — 86	..	..	..	4 1 5
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	..	1⅝ — 2	1⅝ — 2	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	3 %	4 %	5 %	5 %	2⅝ — 3	2⅝ — 3	55/-	..	..	6 13 4
130,100	Do. do. 5 % 1st Mort. Deb.	100	..	..	5 %	5 %	99 —102	99 —102	..	..	..	4 18 0
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½ %	2½ %	2½ %	..	3/16 — 3/8	3/16 — 3/8	..	..	..	6 13 4
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 5/32 xd	1 5/32 — 1 3/16	..	..	..	6 16 7
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½ %	4½ %	4½ %	4½ %	98 —101	98 —101	..	..	..	4 9 1
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	¾ — 1	¾ — 1	..	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	2 — 2½	2 — 2½	..	..	..	10 0 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½ %	4½ %	4½ %	4½ %	79 — 81	79 — 81	..	..	..	5 11 1
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000	1	..	..	5 %	..	3/16 — 7/16	3/16 — 7/16	15/6	..	..	5 14 8
100,000	Westminster Electric Supply, Ord.	5	12 %	10 %	10 %	10 %	8 — 8½	8 — 8½	..	..	..	5 11 1
51,279	Do. do. 4½ % Cum. Pref. (Reduced from 5% since 31st Dec., 1905)	5	4½ %	4½ %	4½ %	4½ %	5 — 5⅛	5 — 5⅛	..	..	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 3 per cent. June 9th. 1910.

THE PROTECTION OF PUBLIC AUTHORITIES.

Cases have often been reported in the Electrical Review which show that local authorities occupy an advantageous position as compared with other bodies. They are entitled to the benefit of the Public Authorities' Protection Act, 1893, which, although it does not protect them from actions altogether, places them in a position far superior to that of the ordinary litigant.

As this Act often comes before the Courts for consideration, and is by no means easy to construe, it is proposed to summarise the decisions.

The theory of protecting public authorities from vexatious actions has long been a feature of the legislation which affects these bodies. The Public Authorities' Protection Act merely repeals and codifies a number of enactments which effected the same purpose in slightly different terms. Let us glance at some of the decisions in order to appreciate to the full the advantage which is there conferred upon the local authorities.

The Act provides, by Sec. 1, that "Where, after the commencement of this Act, any action, prosecution or other proceeding is commenced in the United Kingdom against any person for any act done in pursuance or execution, or intended execution, of any Act of Parliament, or of any public duty or authority, or in respect of any alleged neglect or default in the execution of any such Act, duty or authority, the following provision shall have effect :—

(*a*) The action, prosecution, or proceeding shall not lie or be instituted unless it is commenced within six months next after the act, neglect, or default complained of, or, in case of a continuance of injury or damage, within six months next after the ceasing thereof.

(*b*) Wherever in any such action a judgment is obtained by the defendant, it shall carry costs to be taxed as between solicitor and client.

(*c*) Where the proceeding is an action for damages, tender of amends before the action was commenced may, in lieu of or in addition to any other plea, be pleaded. If the action was commenced after the tender, or is proceeded with after payment into Court of any money in satisfaction of the plaintiff's claim, and the plaintiff does not recover any costs incurred after the tender or payment, the defendant shall be entitled to costs, to be taxed as between solicitor and client, as from the time of the tender or payment; but this provision shall not affect costs on any injunction in the action.

(*d*) If, in the opinion of the Court, the plaintiff has not given the defendant a sufficient opportunity of tendering amends before the commencement of the proceedings, the Court may award to the defendant costs to be taxed as between solicitor and client.

It is interesting to consider the meaning which the Courts have put upon the words and phrases used in this Act. Thus, it has been held that using land as a cemetery is the exercise of a "public duty or authority"; and that taking steps to assert a public right of way, is acting in pursuance of a duty to protect public rights of way imposed on a local authority.

But a company incorporated by private Act for the purpose of completing and maintaining a pier and harbour, and empowered to raise money by rates and dues to be applied for those purposes, and also for the purpose of paying a limited dividend to shareholders, does not exercise statutory or other public duties within the meaning of this section; nor does an independent contractor who is carrying out work for a local authority. (See Tilling *v.* Dick, Kerr & Co., (1905) 1 K.B. 562.)

The words "Public Duty or Authority" have a well-defined meaning: The Act applies only to public authorities, and not to bodies or persons who are mere traders. It applies to a local authority exercising a statutory duty, such, for instance, as the working of a tramway, or the supply of electric light. It also extends to the officers of local authorities.

The Act only applies where the action proceeds to judgment, or where there is an order made by the Court. It does not apply where the action is merely discontinued, but a "consent order" is a judgment within the meaning of the Act.

Where a plaintiff is in part successful, he may have to pay the defendant's costs of those issues on which they succeed as between solicitor and client.

The period of "six months" runs from the time of the doing of the negligent act which causes the injuries; but in the case of personal injury, there is no continuance of the injury within the meaning of this sub-section. An action under the Fatal Accidents Act, 1846, against a public authority, must be commenced within six months, notwithstanding Sec. 3 of that Act.

In the case of pollution of a stream, the time runs from the ceasing of the pollution.

The provision awarding solicitor and client costs, applies only where the defendants are entitled to costs, and does not interfere with the discretion of the Court to refuse costs altogether.

A simple judgment, however, without a special order in a proper case, carries costs as between solicitor and client.

The word "action" includes all actions in the Chancery Division, whether for an injunction only, or partly for an injunction, or partly for damages; but the sub-section generally only applies to judgment in an action, not to interlocutory applications or to appeals, and it does not apply where an action is discontinued.

It applies to actions against public authorities for negligence; to an action for infringement of patent; and to an action for a declaration of right.

It does not apply to actions for work and labour done, or for goods sold and delivered; to an action for breach of a private contract; or to an action for a penalty for acting in contravention of a statute; but it does apply to an action for the recovery of money improperly paid to a sanitary authority in respect of sanitary work.

Sec. 264 of the Public Health Act, 1875, which is in practically the same terms (now repealed), did not apply to an action for an injunction to restrain a nuisance, nor where damages were given in lieu of an injunction.

According to cases on the repealed Sec. 106 of the Metropolitan Management Amendment Act, 1862, that section did not apply to an action for an injunction to restrain a nuisance. Notice of claim and demand of arbitration for damage done to buildings by the Metropolitan Board of Works was not such a proceeding as to render it necessary that it should be made within six months after the damage was caused.

This phrase "person" includes a body corporate, while "Act of Parliament" includes any public or private Act. Hence the period of limitation which is often contained in a private Act may be found to be shortened by this Act.

Having dealt generally with the points decided under the Act, it may be of interest to refer in greater detail to one or two cases.

It was decided in the case of Markey *v.* Tolworth Isolation Hospital ((1900) 1 Q.B. 454) that the limitation of six months overrides any longer limitation which may be found in an earlier Act. Thus, Sec. 3 of the Fatal Accidents Act, 1846, provides that an action for the benefit of the wife, &c., of a person whose death has been caused by the wrongful act, neglect, or default of another, must be commenced within 12 calendar months of the death of the deceased. If such an action is brought against a local authority who comes within the Act of 1893, the period of six months is substituted for one year.

Perhaps the most extraordinary feature of the interpretation which has been put upon the Act by the Court is that it is confined to local authorities. The section to which we have alluded refers to "any person" and the performance of a "public duty." Why should not a railway company or a tramway company be said to perform a public duty? This point was decided in the case of the Attorney-General *v.* Company of Proprietors of Margate Pier and Harbour (1900) 1 Ch. 749). There, in an action, the cause of which is not material, a company sought to plead the benefit of the Act of 1893. Mr. Justice Kekewich, in giving judgment, said it was necessary to give effect to the title of the Act, which was "an Act to Generalise and amend certain Statutory Provisions for the Protection of Persons Acting in the Execution of Statutory and other Public Duties." "If," said he, "that were to be taken in its most liberal construction, any company exercising any power by virtue of an Act of Parliament would come within that meaning. I cannot think that was intended. It is right and necessary to construe the title reasonably, and I read these words as

meaning, 'public duties whether statutory or otherwise.'" In the event it was decided that a pier company was in the same category with a tramway or railway company, and was not entitled to the benefit of the Act.

The case of the *Ydun* ((1899), page 237), which was heard, in the first instance, by the President of the Probate Division, appears to establish the proposition that a local authority may plead the statute, although the duty which they are executing is only of a quasi public nature. There the plaintiffs, owners of a barque, issued a writ on November 14th, 1898, in an Admiralty action against the defendants for damages sustained by the grounding of their vessel on September 13th, 1893, in the River Ribble, within the port and harbour of Preston, through the alleged negligence of the defendants in inviting the vessel to come up where there was not sufficient water in the channel leading to the docks.

The President dismissed the action, with costs to be taken as between solicitor and client. It had been contended that the local authority were here performing no public duty.

Sir Francis Jeune's opinion on this part of the case, which has become almost historic, is well worth recording. He said :—

> It has been, and may be, questioned whether, and to what extent, municipal authorities should be authorised by Parliament to engage, possibly in competition with private traders, in what would otherwise be the subject of private commercial enterprise. But if Parliament decides that a public authority should be so authorised, if it confers on a municipality the right and duty to assume the functions of a trader, it clothes those functions with a public character, and makes them just as much public duties of a public authority as those for the performance of which that authority was created. If a municipality is authorised to supply water or gas, I can see no distinction in character between its acts, its contracts, and its defaults in supplying those articles, and its acts, contracts, and its defaults, in repairing roads or maintaining street lamps.

Nothing short of an Act to amend the Public Authorities' Protection Act, 1893, can eliminate this element of unfair competition in the race for supremacy between public and private enterprise. It may be that to compel the plaintiff in an action to bring suit within six months of the injury is of little real advantage to the defendants; but when we remember that the unsuccessful plaintiff may have to pay the costs of the local authority as between solicitor and client, it is obvious that the position of the municipal tramway undertakers is superior to that of a statutory tramway company.

REVIEWS.

Miscellaneous Tests of Electric Car Equipment. By Parham & Shedd. London: Hill Publishing Co., 1910. Price 4s. 6d. net.

This is an admirable little book which we can recommend to all car-shed employés, foremen and assistant engineers. Indeed, we believe that many a chief engineer would find value for his dollar somewhere between the covers.

It is a book of 134 pp., plus another 20 pp., which contain a formidable examination paper of 393 questions—not the least valuable part of the book if the humble reader will have the patience to master its contents so thoroughly that he can knock over every one of the questions.

As the primary purpose of the authors is to elevate the lowly, who have no great stock of general education, the superior reader must not turn up his nose at the very elementary parts, as, for instance, where instructions are given for reducing hours to seconds. On the other hand, he may pay the closest attention to the remarks upon brush-holder irregularities, tests of motor insulation, field coil mysteries, armature clearance, and the like vital topics.

The first part of the book is given up to stationary tests, and the second part to tests which are taken while the car or the motor is in motion. The simplest explanations are given of the use of voltmeters, ammeters, milli-voltmeters, lamps, and wattmeters for the localisation of faults, or for testing efficiency and other things.

Although the authors wrote for an American audience, car-equipments in this country and in that are so nearly alike in their main features, that no part of the book is useless to an English reader.

If it had been written by Englishmen it would have had something to say about testing trolley standards, and magnetic brakes, and, of course, would have been more complete for the additional matter; but as it stands, there is nothing but good to be said for it, and it might form a fitting companion to "The Motorman and his Duties."

A number of clear diagrams are scattered through the book.

India-Rubber and Gutta-Percha. By T. Seeligmann, G. Lamy Torrilhon and H. Falconnet. Translation from the French by John Geddes McIntosh. Second English Edition. London: Scott, Greenwood & Son. 1910. Price 12s. 6d.

The sub-title of this work is "A Complete Practical Treatise on India-Rubber and Gutta-Percha in their Historical, Botanical, Arboricultural, Mechanical, Chemical and Electric Aspects," but we must frankly say that, keeping in view the date of the volume (1910), it is certainly in many respects not complete, nor in others is it essentially practical. Notwithstanding the fact that the authors in their preface refer to "the greater number of treatises which . . . . . contain, most generally, obsolete information . . . . ," and that they have a "higher ambition, a less futile object" than that of the mere "vainglory of adding another unit to the already considerable number of works," we cannot agree that they have entirely effected their purpose, which, in their own words, was "to combine in one harmonious whole the precious scattered elements of an infinite number of publications, to extract from them their quintessence, and make of them an exact *précis* or *résumé* responding to the needs of the present day."

Despite the authors' laudable ambitions, we are of the opinion that a complete handbook on india-rubber, of the nature indicated, still remains to be written. From the authors' preface we infer that most other works contain much that is obsolete and omit much that is practical or essential, but there is scarcely, in our opinion, a single section in the book under review to which the same remarks do not apply.

Thus, in Chapter I (on *Latex*, &c.), the authors quote as a "typical analysis of Para Latex," an analysis which is neither typical nor illuminating, and which might well have been replaced by one of the many analyses of Hevea Latex by modern workers.

In Chapter V, which deals with the chemical and physical properties of latex and india-rubber, numerous figures of out-of-date researches by Muspratt, Ure, Faraday and others are given, but modern data, which are plentiful and easily accessible, are sadly wanting. The researches of V. Henri, of Spence, and others in regard to latex appear to be simply ignored. In the same way, much—perhaps most—of the modern work on the physical and chemical properties of india-rubber is not referred to, and a great deal that is obsolete is retained.

On page 126 (in regard to the synthesis of india-rubber), we are told that Bouchardat's results have never been absolutely substantiated, yet we were under the impression that Prof. Tidden's work—which, by the way, is referred to on the next page—had amply confirmed that of the French savant. We are also informed that the cost of synthetic rubber is "relatively a little high." A "little"! The classical work of Harries on the constitution of the rubber molecule appears to be unknown to the authors, as also does the work of that author, of Weber, of Alexander and others on the nitric acid derivatives.

In the chapter on "Methods of Obtaining the Latex—Methods of Preparing Raw or Crude India-Rubber," the modern plantation methods are not, apparently, considered worthy of reference, although, in a subsequent chapter, the plantation industry is dealt with in a scrappy and not over-critical manner.

The chapters on the washing, mixing and vulcanising processes contain much useful information and many illustrations, but here again much that has been inserted might have been omitted and *vice versâ*. In the chapter on vulcanised rubber it is stated that "it is impossible to give an elementary composition, however imperfect, or to ascribe any formula

to vulcanised rubber." In view of Weber's researches this is somewhat remarkable, as is also the view that "a good vulcanised rubber ought always to have a lower density than unity." If by "good" is implied commercial quality, the statement is open to serious criticism. The treatment of the subject of waste rubber is scarcely up-to-date, and by no means gives an accurate bird's-eye view of the industry. The same remarks apply to the chapters on "considerations of mineralisation." In dealing with the analysis of rubber goods the authors have simply ignored a great deal of the more important modern literature on the subject.

The translator cannot be entirely congratulated on his labours; the book abounds in mis-spellings, and quaint grammatical constructions.

Although the work under review has, as we have striven to indicate, many serious failings, it, on the other hand, contains a good deal of information which is not readily accessible elsewhere, and for this reason, perhaps, it will find a place in the library of those who are more particularly interested in the scientific or commercial aspects of the india-rubber industry.

Das Elektrische Bogenlicht. By Ewald Rasch. Volume 12 of "Elektrotechnik in Einzel-Darstellungen." Brunswick: Fried. Vieweg & Sohn. Price M. 6.

This volume deals in a very thorough manner with a small though important branch of electrical physics, which is only partially considered in the existing text-books, viz., the conditions under which electric arcs and other forms of discharge are produced, as distinguished, on the one hand, from the construction of arc lamps (already dealt with in Vol. 6), and, on the other hand, from the question of light emission and illumination (covered by Vol. 8).

The whole treatment is based on the electronic theory, which enables an insight to be obtained into many obscurities in the behaviour of the arc.

Chapter I gives a general survey of arc phenomena, and is followed by a consideration of typical D.C. and A.C. arcs in Chapter II. Chapter III is concerned with the physical properties of the various electrode substances. Chapters IV and V deal with gas discharges from the theoretical and experimental points of view. Chapters VI and VII deal with the characteristic curves of arcs and the space distribution of energy in the arc, and are largely based on Mrs. Ayrton's experiments. The mercury vapour arc is also considered. The last chapter (VIII) deals with various photometric problems.

The book can be thoroughly recommended, as it not only gives a sound *résumé* of the existing knowledge of arc phenomena, but also contains suggestive discussions as to possible future advances.

THE ADDITION OF LOW-PRESSURE TURBINES TO EXISTING STEAM ENGINES.

[COMMUNICATED.]

It is now commonly conceded that a marked improvement in steam consumption can be obtained by resetting the slide valves of the engines for non-condensing conditions, and introducing a low-pressure turbine between the engine and condenser.

A great amount of data has been published in support of this contention, which, although showing what can be obtained in steam consumption, does not consider the many other points entering into the problem from the commercial standpoint.

There are two conditions under which the advisability of installing a low-pressure turbine may be considered:—(1) To reduce the fuel cost per unit generated; (2) To increase the capacity of the plant. An increased capacity of about 30 per cent., compared with the normal full load, and 50 per cent., compared with the overload capacity of the plant, necessarily follows the introduction of a low-pressure turbine, so that if the increased capacity cannot be utilised, a part of the plant must be shut down, but it does not follow that the best arrangement will be the same for both of the conditions, because the capacity can be increased at the cost of steam consumption if that is the most important feature.

In practically no case should a turbine of less capacity than 300 KW. be used, while 600 to 750 KW. would be preferable. If connected to a quick-revolution engine of the type so largely used for driving generators, these turbines would require engines of about 350 and 1,000 KW. capacity respectively, when working non-condensing, to supply them with steam at full load, or, if several engines are connected to one turbine, then the steam from them would have to be a similar total quantity to get the full-load capacity out of the turbine.

The next important point is the condensing plant. If a single central condenser exists for several engines, then it can probably be utilised for the turbine, but in a case where each small engine has a separate condenser attached to it, a complete new condensing plant will be required, with a lot of exhaust piping, so that the expenses on the capital outlay may exceed the saving in fuel cost. Admittedly, there are many stations where the conditions offer great possibilities for the addition of a low-pressure turbine, but not to the extent claimed by some enthusiasts, who would tack a turbine on to every engine running.

The ideal conditions are somewhat as follows: Vertical engines of not less than 750 KW., when run non-condensing, exhausting into a single condenser placed alongside on the same floor or in the basement below the floor level. The turbine can then be placed directly over the condenser and supported on rolled mild steel girders, with short pipes connecting to the engine exhaust and to the condenser inlet.

The second best conditions are when two or three engines totalling a similar capacity are connected to a single condenser. Here again the turbine can be placed over the condenser and the existing exhaust mains utilised.

The advantage of a good vacuum for a turbine is well understood, though in these cases there is little to be gained in going over 27 in., because the turbine only generates about one-third of the total load under full-load conditions. The greatest difficulty to contend with in maintaining vacuum is the question of air leakage, and it will be found that in most cases of existing condensing plants the designers have taken care to provide air pumps of ample capacity, owing to the air leakage at the low-pressure cylinder piston rod glands and at flange joints, especially when there is any length of piping in the exhaust mains. The air leakage at the spindle glands of a turbine can be kept very low, and the exhaust mains have a slight pressure instead of a vacuum in them under the changed conditions, so that an air pump which formerly maintained 25½ to 26 in. of vacuum would probably be found capable of maintaining 27 in. under the changed conditions. The condensing capacity of many existing condensers can be considerably increased by improving the steam distribution amongst the tubes. The withdrawal of a few tubes to provide passages amongst the remainder has oftentimes been found a marked advantage, while making the water pass through a less number of tubes at a time, and so increasing the water velocity and the number of passes through the condenser, will also give better results. This reqnires a little more power, but in many cases the increased speed of the pump to give the additional water required at the increased head can be obtained without any great alteration.

The whole question is simply one of capital cost, and must necessarily be worked out for each specific case; it is certainly worth careful consideration in many instances.

Many engineers still view the turbine with distrust from the operating standpoint. There is one great point in favour of low-pressure, as compared with high-pressure, turbines. This is, that it is not subject to those conditions which have led to most of the operating troubles experienced with high-pressure turbines. Owing to the large volume of steam at low pressure and the little pressure difference between the stages, much greater clearances can be allowed between the working parts where steam leakage can occur on low-pressure than on high-pressure turbines.

Also the risks of distortion are very small at the low

temperatures, so that these two items permit of working clearances being allowed which place all likelihood of fouling practically out of the question. If the turbo-generator be considered simply as the low-pressure end of a complete set and connected to the same bus-bars as the engines, so that no speed governor is required or any stand-by supply of live steam to make it independent, then the first cost of turbo-generator and electrical apparatus can be considerably reduced over the cost of sets fitted with a varied steam supply and made independent of the engine set. When considered in this way the arrangement will be found to give better results from the financial standpoint.

SALES ORGANISATION IN INDIA.

By G. E. WRIGHT, M.I.E.E. (Electrical Engineer, North-Western Railway, India).

In view of the close attention with which the exploitation of foreign and Colonial markets is being studied by British electrical manufacturers, some remarks on the above question, as particularly applied to our great dependency, may be of interest.

There are some special features in the Indian market which sharply differentiate it from those of the other large Colonies. Hence a special consideration of its requirements, and of the methods by which those requirements are to be met, is needed.

This article will deal with the best methods of exploiting what is, and will be for some time, the most remunerative market for the home manufacturer, namely, the Government, the Railway Companies, municipalities and other large public and private undertakings which are under European control, as far, at any rate, as technical mtters are conc rned. The native mercantile community is not, at present, of sufficient potential value as a customer for electrical plant to render a detailed consideration of its requirements necessary.

The three methods by which a seller can bring his products before a prospective buyer may be classified as (1) Catalogue matter; (2) Special quotations; and (3) Personal interviews. In each of these divisions the methods differ from those by which similar business is handled at home.

1. *Catalogues.*—The Indian electrical engineer is necessarily far less in touch with the latest developments than his brother at home. The latter will often have acquired sufficient knowledge about any new production, and will have formed his opinions thereon, before information of same reaches him through a maker's circular. He will, therefore, give but scant attention to same, and the manufacturer's descriptions of and claims for his products will, unless of exceptional interest, seldom receive careful attention. For example, he hears from one or two of his professional brethren that Messrs. "Jones & Brown's" arc lamps have not given them satisfaction, and a ton of gilt-edged testimonials and catalogue matter would be powerless to alter the unfavourable opinion he has formed.

Here, in India, we have generally no such prior sources of information, and a manufacturer who can put forward his claims in a carefully written and well reasoned form, well illustrated and clearly described, may be sure that his pamphlet or catalogue will be read and will not be summarily consigned to the waste-paper basket.

Such catalogue matter must, however, be very complete. The usual type of pamphlet, consisting of one or two illustrations of the exterior of the apparatus or plant, a brief description, and, perhaps, a few testimonials, with the announcement at the end, "further prices and particulars on application," is useless. This is good enough for home use, no doubt, where, if the prospective buyer is interested, a post-card or a telephone message will speedily bring the manufacturer's Sales Engineer to discuss the whole subject as fully as the purchaser desires. Here, in India, we have no such facilities, and if the pamphlet does not give such full and complete information as may enable us to get a very good idea of the plant, its sizes, prices, uses, &c., we are not always disposed to write to the home manufacturer on the subject. Often, too, when we have to estimate for articles, we have not the time to do so, because to await a reply means in all a delay of some five weeks.

The manufacturer, therefore, who gives complete information in his publications, has a very considerable advantage over one who does not, as, when we find in one catalogue full particulars and prices, in another very general descriptions, and, perhaps, a few pretty pictures, naturally the former articles go into the estimate or indent.

The need for complete information can hardly be over-emphasised. The manufacturer who sends a catalogue abroad must look upon it as his representative, and must see to it that it goes to his correspondent as fully charged with information as his Sales Engineer would be were he making a personal call on a prospective customer. There are excellent reasons, no doubt, which restrain a manufacturer from scattering his prices broadcast through the trade at home. These do not, in the least, apply to Indian business, as there is no likelihood that the prices in question will fall into the hands of any of his competitors.

If the manufacturer will bear the above facts in mind, and will realise that his general catalogues, and his particular quotations, should tell his prospective customer everything he can possibly want to know on the subject, he will not fail to reap his reward.

Most catalogues will not have any provision for the insertion of a complete schedule of prices. Some may, therefore, be typed and attached to same. Let this be done securely, as printed matter receives less considerate handling here than at home. The custom of giving a schedule of prices in the body of a covering letter is bad. No one files his catalogues and his correspondence together, and the necessity for a double reference is a nuisance.

As to the form of the catalogue, nothing is so good as a stout folder containing separate pamphlets all of uniform size. The supersession of obsolete matter is thereby rendered so very easy by the publishing of additional pamphlets, and the catalogues can be kept complete and up-to-date with a minimum of trouble to the user. The lists of a few of our leading firms leave nothing to be desired in this particular. But, alas! how many are far different! How often does one receive a small paper-bound catalogue full of loose insets! These, dealing generally with the most recent products of the manufacturer, are the most important parts of the catalogue, but they are seldom uniform in size either among themselves or with the pages of the main catalogue. No expenditure of gum or thread will reduce these "disjecta membra" to a symmetrical and "fileable" whole.

Picture the Indian engineer referring to such matter; his office is at a temperature somewhere between 90° and 100° F. An electric fan is working overhead to make the room habitable, and his temper, excusably, is hardly in the same profound state of serenity as that of his brother engineer in his Westminster office. He opens the list. The loose insets which for some diabolical reasons are nearly always printed on very thin paper, are picked up by the breeze of the fan and scattered over his office. They are retrieved. His search for the article he wants is rewarded by a few pretty pictures, and perhaps some testimonials, but no list of sizes, with schedules of main dimensions, no weights, no diagrams of connections, and no prices. Such a catalogue is mere waste paper to our engineer. He will, unless uncommonly meek, consign the catalogue, its proprietors, and all their works, to "another place," and specify the goods of the manufacturer whose carefully compiled lists give him all he wants. "Oft the apparel doth proclaim the man," and to us engineers in India a "sloppy" careless catalogue makes us suspect "sloppy" careless work.

The answering of inquiries is another most important link in the chain which leads to the desired order. Many manufacturers fail lamentably in this direction, because they do not appreciate that an inquiry, from the class of prospective customers under consideration, requires very different handling from a similar inquiry from a home engineer. Let us take a concrete case.

An engineer has to prepare a scheme with estimate for a power house of moderate size. He will not, of course, be able to get prices and particulars of his generating sets,

boilers, condensing plant, &c., from catalogues, as, of course, no manufacturer can be expected to issue price lists of such things, the conditions varying so enormously. He will, therefore, have to address one or two makers for quotations.

The inquiry as received by the manufacturer will vary greatly. If framed by an Engineer, who knows exactly what he wants, it may be perfectly definite, giving specifications and schedules, with drawings. It may, on the other hand, be a general query from a man who does not really know what he wants, but wishes to get information as to what is most suitable for his needs.

The former is far easier to deal with. The quotations should be accurately to specification, but, and this is to be particularly noted, the manufacturer should go further. He should study the specification; he should be particularly careful to draw attention to any alterations thereto, which, in his opinion, would be advantageous, and he should quote for such alterations. The best of us here in India stand more open to correction than our brethren at Home. It is often years since our last visit to England, and, however we read, we cannot keep up-to-date, as we stand outside the ebb and flow of contemporary engineering opinion on which, in reality, all experience is built.

The reasons for such alterations should always be fully stated. Indeed, the whole quotation should be very full. It is far better to put in too much than too little. If incomplete in any particular a delay of some five weeks is involved before the matter can be cleared up by another reference home. Often the engineer cannot wait. Naturally, therefore, the manufacturer who gives no cause for doubt in his quotations, will get the preference.

The second, the indefinite type of inquiry, gives the manufacturer much more trouble. He has practically to act in an advisory capacity, and to prepare a comprehensive scheme for his correspondent. He may consider that this is not worth while, and may send some stereotyped reply—such as, "that he will be happy to quote, on receipt of more definite particulars," or he may give some quotation for his stock manufactures, which may be quite inappropriate to the particular case.

The writer would hold that he is wrong in so doing, and that it is essentially well worth while to give the greatest care to such inquiries. The definite inquiry, first described, is obviously from a man who has a fairly thorough knowledge of the electrical trade as to who are and who are not the leading makers in any particular line, and knows that, say, Messrs. A's generators, though first class, are no better than those of Messrs. B or C. The indefinite inquiry comes from a man who has no such knowledge. It is, therefore, quite possible for the manufacturer to impress him with the the fact that his own products are really just a little better than anybody else's. (There is no hypocrisy in so doing. Every manufacturer of first-class plant does believe it, just as the public school boy fully believes his school to be better than any others.) Nothing is so certain to bring about and foster this impression as careful, intelligent, and painstaking attention to inquiries.

The result will not necessarily be a direct order, but it will certainly be that, if, and when tenders are called for, the specifications on which they are invited will be practically those of the contractors who have given the fullest information in their preliminary quotations. And this, in any competitive tender, gives a great advantage.

Next as to the question of prices. Here most firms again go astray through ignorance of the conditions. In most cases the prices quoted will simply be used for estimating and indenting purposes, and will not be firm quotations at which the manufacturer has to supply. In these cases, the figures should be as close as possible to what the manufacturer would actually quote on a competitive tender. It is absolutely wrong for the manufacturer to quote prices 10 or 15 per cent. in excess, with the idea that he is covering himself for possible changes in the market by quoting rates with a large margin, and he is often only spoiling his own business in so doing.

A very cogent example happened in the writer's early days in this country. He was preparing an indent, of which the chief item was for large 40-ton electric travelling cranes. The bulk of the available funds was for these cranes, but there was a margin with which he was providing for a certain number of motors. He obtained preliminary quotations for the cranes from a firm of electrical engineers, and on these he based his indent, utilising the available balance for the purchase of a few motors. The actual cost of the cranes came out at nearly 20 per cent. under the preliminary quotation—in round figures, a difference of about £1,300. Hence, if a close quotation had been given, the writer would have been able to purchase £1,300 worth of motors under that indent. The order for the motors went to the very firm who had given the preliminary quotation for the cranes. Hence their order book was £1,300 the poorer, simply because they did not quote a close figure for the cranes.

An intelligent perusal of an inquiry will almost always enable the manufacturer to see at once whether the quotation is required for an immediate order or for estimating purposes only.

A few words on the subject of personal representation in India may fitly conclude this article. The two methods which may be adopted are:—(1) The appointment of local agents; (2) The establishment of an Indian office. The former is far the cheaper course, as local business houses are generally prepared to accept agencies on a commission basis, with comparatively small charges to cover office and travelling expenses, &c. While a fairly satisfactory arrangement for the maker of ordinary supplies, fittings, and the like, it is seldom a productive arrangement for a manufacturer of heavy plant.

The reason is not far to seek. The Indian agents will be a firm of general engineers who have a more or less extensive electrical department, there being in India no firms of standing who are exclusively electrical engineers. Such electrical department will not have more than one or two professional electrical engineers on its staff, and of them not even one will be charged with sales work alone; he will also have to devote his time to the supervision of contracting work, &c., which, normally, forms a not inconsiderable branch of the work of such a firm. The sales work is, therefore, confined to a hurried and limited tour once or twice a year, and to the following up of such definite inquiries as may be received. There is no leisure for that most important department of sales activities, which may be described as "Missionary work." Such an engineer, also, will not have any intimate knowledge of the products of the firm he is representing, his acquaintance therewith being, perhaps, confined to a few days' visit to their works when he was last in England. Often, indeed, he will have no tangible acquaintance with them at all, his knowledge thereof being confined to the various publications with which the manufacturers may furnish their agents. With so meagre an equipment of information, such a man cannot be an efficient representative.

Perhaps the most necessary qualification for the Sales Engineer is a complete knowledge of what he is selling; without such, he will often be nonplussed by questions or statements from a shrewd customer. The writer has indeed been called upon by gentlemen who had considerably less acquaintance with the products of their principals than he had himself. Such visits serve no useful purpose.

The Indian Office is essentially the proper method by which sales work should be conducted. It is, however, expensive, but, for the firm which foresees potentialities for any considerable business in India, it is to be confidently recommended. One office at Calcutta or Bombay will generally suffice (an office in both cities is hardly necessary unless the Indian business is very large).

The qualifications of the man in charge are of the utmost importance. First, he should have been on the manufacturer's technical staff for some years, and have a really complete knowledge of their products. He must know the plant he is selling from "top to bottom," and must also have a fairly considerable knowledge of the products of his competitors in the same line of business. Sound commercial knowledge is also necessary. "Pushfulness," which is a very useful asset for the Sales Engineer at home, is not needed here. Anything, indeed, approximating to the methods of the commercial traveller, is to be particularly avoided. We welcome the engineer who calls upon us in the interests of plant which he thoroughly understands, and are prepared to

listen to him just as long as he has useful information to give us. We have, however, no use for the mere "box-wallah" (Anglice, "bag-man").

The membership of one or more of the Engineering Societies is very desirable. This counts for far more here than at Home. The M.I.E.E. on the card tells us at once that we have to deal with an Engineer and not a mere traveller.

It is desirable that our Sales Engineer should have some social qualifications. Such are of use here where a man's business and social life are so intimately interwoven.

Physique is of importance. Travelling in India, with its long railway journeys, its discomforts, and its more than indifferent food, is a great tax on any but the strong and vigorous. The illness of the Sales Manager may often be quite a serious matter, resulting in business going past him, simply because he is at the critical moment *hors de combat*.

It will be observed that the above outline of qualifications indicates a man of considerable experience and ability, and hence a fairly expensive man. This serves but to bring out a point that must be insisted upon, namely, that the man must be really good. A "second grade" representative is hardly better than none at all. Often, indeed, he is worse, and does more harm than good to the firm he represents.

The manufacturer having decided that he really does want Indian business must not adopt a "penny wise and pound foolish" policy. He must be prepared to face an expenditure which, on English lines, will appear lavish. Also as we, here in India, move slowly, he must not look for immediate results. Substantial results are, sooner or later, certain, and provided the plant, when in operation, confirms the favourable predispositions of the purchaser, he may confidently expect repeat orders, as here, in India, we have far more cogent reasons for confining ourselves to one make of plant, so that complete interchangeability may be obtained.

If funds permit, the Sales Engineer should certainly have an assistant. He will often be away from his headquarters for fairly lengthy periods, hence someone on the spot is desirable who can deal with routine business and send preliminary information in reply to inquiries. A young engineer from home, of good address, but not necessarily of much experience, will suffice. The engagement of a man here in India is not generally to be recommended.

Clerical Staff is not a large item; two or perhaps three native clerks and one or two native draughtsmen will suffice.

Office rent is a serious item, and it may surprise some of our readers to learn that office accommodation in the best parts of Calcutta or Bombay is fully as expensive as in the heart of the City of London.

Travelling expenses are a very heavy charge, owing to the long journeys.

The total standing charges of an Indian representation may, therefore, reach £2,000 per annum, and may substantially exceed that figure if very much special travelling is necessary.

A fairly large business is needed to make such an office pay, but not more than a manufacturer of large plant may fairly expect to do, in view of the great advantage which his local offices will give him over his competitors who are not similarly provided. It must also be remembered that the margin of profit on such business is more liberal than at home.

The foregoing has been written to set forth the method by which the most profitable branches of Indian business may best be exploited by the Home manufacturer. It is for the latter to decide whether he is prepared to incur the expense necessary to attain this object.

Kelvin Statue.—The *Times* states that the statue of Lord Kelvin, by Mr. Albert Bruce-Joy, which is to be erected in Belfast, Lord Kelvin's birthplace, is nearly ready. The figure stands 10 ft. high. On the right hand is a design of Kelvin's gyroscope, and on the left a model of the Kelvin compass. The statue will be cast in bronze.

Scholarships.—The Cheshire Education Authority has awarded technological scholarships in electrical engineering to E. Hill (Hale), Lionel S. Smith (Ashton-on-Mersey) and H. W. Gawthorne (Crewe).

NOTES ON HIGH-TENSION UNDERGROUND CABLES.

By R. E. NEALE, B.Sc. (Hons. Lond.), A.C.G.I.

Overhead transmission lines possess many advantages over underground cables for high-tension work, the most apparent of which are lower capital cost, including cheaper insulation, and easier accessibility for inspection and repair. Nevertheless, in congested areas, such as large towns or cities, overhead high-tension transmission is impracticable, owing to the great and varying height of buildings, the difficulty of installing the system, the danger arising from other overhead wires (power, telegraph and telephone), and the rapid deterioration of the line by atmospheric corrosion. High-pressure transmission, at one time almost entirely confined to water-power transmission schemes, has now become essential in congested areas, particularly where outlying districts are also supplied, owing to the concentration of generation in huge central stations.

For some time high-tension transmission has been underground in cities, and this system is gradually coming into use in outlying districts, especially such as will ultimately be swallowed up by the expansion of the congested areas. Underground cables will never be used for long-distance cross-country high-tension transmissions in place of overhead lines, for no sufficient advantage would result from such an arrangement to compensate for its greater cost.

Underground cables for city power distribution, in tubes and so on, operating at 5,000-12,000 volts (three-phase A.C.) are now fairly common in England and elsewhere. In the Durham power scheme there are some 100 miles of 20,000-volt underground cable in satisfactory operation. This cable has three cores, paper-insulated and lead-sheathed; the cable is laid solid in porcelain ducts, and was tested, after laying, to 40,000 volts. Short lengths, tested in the works, stood 80,000 volts after a severe mechanical bending test.

Extra-high-tension underground mains and their accessory protective devices have been so far developed that, on the occurrence of a fault, the circuit is often broken before the breakdown has become sufficiently pronounced to enable its localisation. The circuit has then to be reclosed, possibly several times, till the fault becomes "complete"; "partial" faults form one of the most annoying troubles of the central station engineer.

Methods of Laying Underground Mains.—English practice as regards high-tension cables largely favours the use of paper-insulated, lead-sheathed cables supported on bridge pieces in earthenware or wooden troughs which are filled in with molten bitumen and covered by planks or tiles ("solid" system). The perfect exclusion of moisture is an important matter in solid laid systems; if this condition be neglected, damage by electrolysis is certain.

The use of lead-sheathed, steel-armoured cables, laid direct in the ground, and more or less protected from mechanical injury by a wooden plank laid over them, is common in colliery installations in England and on the Continent. In many soils (such as those of parts of India and Italy), such cables would be hopelessly corroded within the space of a few months.

Armoured cables laid direct in the ground cost (*in situ*) 5-10 per cent. more than lead-sheathed cables laid "solid," but, providing the lead is well taped before armouring, and the armouring itself is well braided and the whole thoroughly impregnated, the life of the cable is at least equal to that of the simpler cable laid solid. The armoured cable system is simple, effective and cheap; it is suitable for non-congested districts and for conditions under which electrolytic and chemical corrosion will not be serious.

In congested areas the "conduit" or "drawn-in" system of laying is almost universally adopted, since the opening of streets for extensions or repairs of the cable system is then a serious matter. The multi-duct system is almost invariably employed in such cases, the laying of several cables in one duct being obviously very risky. The ducts should be as nearly equal to the size of the cables as is possible, since

air spaces reduce the cooling rate of the cables. In any case the cooling of a block of cables carried in conduits occurs at a much slower rate than does that of a single cable. As a consequence of this fact, it is usual to employ a smaller number of larger cables than are otherwise desirable, so reducing the number of cables required and facilitating cooling. Care is required to prevent a fault on one cable from affecting others in neighbouring ducts.

A serious consequence of the multi-duct system is that, by more or less restricting cables to certain routes (except in very large systems), the flexibility of supply is sacrificed in many instances and excessively long branch service cables are required.

In congested districts covering a small area, radial cable routes are usual, but if larger areas have to be supplied "ring mains" are generally adopted. For information concerning methods of isolating faulty sections of ring mains with maximum certainty and minimum derangement of supply, see Electrical Review, August 28th, 1908.

Life and Causes of Breakdown of Underground Cables.—High-tension underground cables (up to 20,000-25,000 volts working pressure) are now as reliable and as rapidly repaired as any other part of the plant of an electric power scheme. Cable breakdowns now account for no more than 5 per cent. to 10 per cent. of the total cessations of supply, and from 30 per cent. to 40 per cent. of such faults are due to purely "external" causes—such as damage by picks, by burns from adjacent cables, and so on. Different countries introduce different sources of trouble: thus, in America, heating and leakages from steam mains have caused many cable breakdowns in the past.

One breakdown, whether on the generators, cables or load supplied, often causes very severe electrostatic or mechanical stresses at other parts of the system, and thus causes other faults to appear within a few days. Very noticeable groups of failures, probably thus caused, may be observed in the fault records of all large power supply systems.

Next to "external" causes, failure of cable joints is the most important traceable cause of faults. The actual method of jointing is hardly less important than the choice of a suitable insulating material. A good mechanical joint having been secured, it is important that no air be left in the interstices of the completed connection. The jointed conductors should be carefully taped, each turn being well painted with some reliable, non-drying, insulating varnish. The joint should then be thoroughly impregnated with hot compound. Paraffin wax may be used as a joint insulator, though its considerable contraction is often a disadvantage; well-boiled wax is free from air.

The use of paper tubes round the joint of each conductor is a convenient method of ensuring that a safe minimum of insulation is provided. The insulation resistance of a cable joint should be greater than that of the cable itself, so that there is no risk of subsequent trouble at the joint.

Puncture by surge pressures is now a much less prolific cause of breakdown than formerly, owing to the better understanding of the conditions leading to resonance, and of the surges caused by switching. The practice of connecting cables to generators before starting the latter is seldom possible, and is, in any case, subject to numerous disadvantages, not the least of which is the danger of running the generator for an appreciable time at a resonant frequency. A much simpler and more satisfactory means of avoiding the sudden application of full pressure to a cable is to switch on through a high water resistance, which is then gradually cut out of circuit.

Some cables are particularly unfortunate in their resonant properties and in the frequency of the harmonics of their supply voltage. In other cases, a particular length of cable, often the middle third, may be specially subject to breakdowns by surges. Gap discharge paths should be connected to the centres of such lengths. To guard against the transference of pressure surges from overhead to underground cables, spark-gaps and water discharge paths are invariably inserted at the point of changing from the overhead to the underground route.

Surge voltages may rise to two or three times the working pressure, or, in the case of very high frequency oscillations, considerably higher. In the latter case, however, the frequency is often so high as to make the risk of serious damage slight. Arcs in a cable circuit are most dangerous as leading to serious surges.

It should be noted that surge pressures are proportionately less serious in high-tension than in low-tension cables; the factor of safety of the former is, however, the lower. (See later.)

Bends rarely cause failure if the cable be well made and tested.

Suppose two supply systems to be identical in every respect except that one supplies 5,000 kw. and the other 50,000 kw. Faults on the cable system of the latter, while occurring no more frequently on each cable, would generally be far more serious than those on the smaller system. This would be due to the much greater electromagnetic and electrostatic energy and mechanical momentum of the generators ready to "feed back" on any fault in the system. Pressure alone does not determine the gravity of a breakdown. [Thus the bursting of a large hydraulic main fed at 700 lb. per sq. in. and in connection with a large hydraulic accumulator, would be accompanied by far more damage than the collapse of a small experimental 700 lb. per sq. in. piping, even supposing both to be fitted with equally rapid cut-off valves.]

The Public Service Corporation (New Jersey) found that of 52 faults occurring on their 13,200-volt three-phase cables in three years:—

16	were due to external causes	=	30·8 %	total number.
11	„ „ joint failures	=	21·2 %	„ „
25	„ „ true "breakdowns"	=	48·0 %	„ „
52			100·0 %	

Again, the Manhattan Electric Railway, employing over 350 miles of 11,000-volt cable, reports that the mean cable breakdowns on their system during the past 10 years, and including surges, joint failures and external causes, have been two per 100 miles per annum. Excluding external causes and surges, the average faults per annum now equal one per 400 miles on this system.

With regard to the life of high-tension underground cables, rubber-insulated lead-sheathed cables have a useful life exceeding 20 years. Such cables are now largely replaced by paper-insulated lead-sheathed cables, which wholly depend for their insulation on the continuity of the lead sheathing. There are not yet sufficient data to form a reliable estimate of the life of the latter, but under favourable circumstances it should not fall short of 15 to 20 years. The durability of paper cables depends entirely on the soil, moisture and earth currents to which they are exposed.

To reduce the risk of damage to the lead sheathing, especially in single-core a.c. cables, by the currents induced in it, the sheath should be earthed or, in the case of armoured cables, connected to the armouring at frequent intervals. The external metallic sheath, whether of lead (unarmoured) or steel (armoured) is generally grounded throughout its length; it is then exposed to chemical and electrolytic corrosion.

Limiting and Test Voltages.—The pressure which a given cable will withstand without permanent damage to its insulation depends greatly on the time during which it is applied. This is most fortunate, since many surges of pressure, which would cause puncture of the insulation if maintained, actually die down before any injury is produced.

Extra-high-tension cables should be able to withstand from 2 to 2½ × their working voltage phase to phase and phase to earth for five minutes without undue heating and with no injury to their insulation.

Once a cable is installed it is hardly wise to subject it to periodical pressure tests. The latter produce no useful result, and are liable permanently to damage the insulation of the cable. It is preferable to rely on periodical measurements of the insulation resistance, and to make every provision against electrolytic damage: every opportunity should be taken to examine cables for signs of such damage, and its nature, rapidity of extension and conditions of occurrence should be noted.

Cables operating at 20,000 volts or higher pressures have an appreciably lower factor of safety (as regards breakdown pressure, safety devices, &c.) than have 6,000—10,000-volt cables, but this is generally quite permissible. For cables working at 25,000 volts or over it becomes necessary to use fairly large conductors in order to reduce the intensity of the

electrostatic stresses. On this account, and because of the considerable thickness of insulation required, three-core cables become unwieldy in such cases. It is, however, proportionately more costly to use three single-core cables : also dangerous pressures may then be generated in the lead sheaths if the latter be insulated, while if they be earthed the sheath C^2R losses become serious. For single-core cables operating at 40,000 volts or over, these points become of considerable importance. For pressures exceeding 30,000-35,000 volts single-core conductors are probably best, for, apart from their cumbrousness in service, cables larger than 3 in. in diameter cannot be satisfactorily lead sheathed at present. Cable manufacturers are already willing and able to supply 50,000-volt, or even 75,000-volt cables, should such be in demand ; so far as can be foreseen these cables would be proportionate in price, size, and safety to those made for voltages below 30,000 volts. Most of the advantages of 30,000-volt cables over 10,000-volt cables would be possessed by the 50,000 or 75,000-volt lines, as compared with 30,000-volt cables. It is not probable, however, that underground cables will be used for pressures higher than 30,000 volts for many years to come, and it is impossible definitely to determine at the present day, whether it would not be better to duplicate 30,000-volt cables rather than use a single cable at a higher working pressure.

There is no doubt that underground cables can now be made to deal safely and efficiently with higher pressures than have yet been attempted in the localities to which underground high-tension transmission is confined.

Overhead and underground transmissions (high-tension) both have their special applications, both are admirably suited to their own cases, and neither seems likely to interfere or even to compete with the other.

ELECTRICAL DEVELOPMENTS IN GERMANY.

[The following article, with the exception of the two final paragraphs, was already in type when the contemplated financial absorption or control of the Felten & Guilleaume-Lahmeyer Works by the A.E.G. was officially announced, as was briefly recorded in our last issue.]

The period of fresh movements and transactions in the German electrical industry, the *Frankfurter Zeitung* states, has only commenced with the acquisition by the Zurich Bank for Electrical Enterprises of the majority of the shares in the Lahmeyer Co., of Frankfort-on-Main. The association of the group of the A.E.G. to the Lahmeyer group which has thereby been accomplished calls forth, as was probably not otherwise to be expected, counter transactions of other groups on the one hand, and on the other, efforts to perfect the policy of association begun in connection with the A.E.G. Unconfirmed stories, which appear with great definiteness, of course say that the A.E.G. will desire in the near future to obtain direct influence in the Felten & Guilleaume-Lahmeyer Works, of Mulheim, by the acquisition of a large amount of the shares in the latter company partly from the portfolio of the Frankfort Lahmeyer Co., and partly from large shareholders at Cologne, in return for the issue of A.E.G. shares. Under circumstances, this operation would be associated with a very considerable increase in the capital of the A.E.G. ; it is alleged otherwise that an offer of taking over new shares of the A.E.G. is to be expected.

The share capital of the Felten & Guilleaume-Lahmeyer Works amounts to £2,750,000, of which £800,000 is in the possession of the Frankfort Lahmeyer Co. and is booked at the price of 110 per cent. If now the A.E.G. were to acquire one-half of the holding of the Lahmeyer Co. in the Mulheim company's shares and also somewhat more than twice the amount from the possession of other shareholders in the Mulheim undertaking, these transactions would bring into the hands of the A.E.G. about one-half of the shares in the Felten & Guilleaume-Lahmeyer Works, and the definite connection of the latter with the A.E.G. would then be accomplished. That such a connection is probable in the course of the further development which has been paved by the successful offer of the Zurich Bank for Electrical Enterprises of shares in exchange for Lahmeyer shares, has been previously emphasised by the Frankfort newspaper, which pointed out the mutual advantages of the combination of the cable and dynamo works of the two undertakings, and the influence of the A.E.G. in the world's cable market.

The powerful advance of the A.E.G. is, in a certain measure, automatically producing similar tendencies in the case of other electrical undertakings, as, in addition to the prevalence of certain ambitious efforts, the recognition predominates that only undertakings which are approximately of equal strength will be able to successfully compete with one another in the long run. In this connection it is explicable for reports to be circulated of endeavours to pave the way towards an understanding between the Siemens and Halske group and the Bergmann Electricity Works Co. It can, however, be characterised for the time being as improbable that an understanding will result between these two works up to a certain interchange of shares, to say nothing of a complete amalgamation, to which personal questions would perhaps be opposed. On the other hand, it does not seem to be out of the question that an attempt will be made to bring about a community of interests between the Siemens group and the Bergmann Works. Such an association is furthered by the similarity of the financial relations of both groups, as the Deutsche Bank possesses the lead in the financial syndicates of both undertakings.

It is understood that leading personalities of the Siemens-Schuckert group have recently conferred with the principals of the Bergmann Co., and representatives of the former have also visited the works of the latter company. Conversely a technical member and a commercial representative of the Bergmann Co. are shortly to make an inspection of various departments of the Siemens-Schuckert Works. It is obvious that after the events of recent weeks outsiders attach a definite purpose to these conferences and inspections—this all the more because the disposition for a mitigation of the competitive fight outside the almost ineffective electrical price protection syndicate, which, in the meantime, is to collapse, must be admitted also by the principal outsider in the form of the Bergmann Co. It is, however, even assured that such inspections have no other significance than that of an exchange of visits, such as are not extraordinary between friendly, although competing, industrial undertakings, and which have previously taken place between Bergmann and Siemens, and also between Bergmann and the A.E.G. In particular, Siemens and Bergmann are not strangers to one another, as they have repeatedly given mutual orders.

Another point of importance has to be taken into consideration which appears not to leave out of question an association between the Siemens group and the Bergmann Co. The latter, the Frankfort newspaper proceeds to remark, stands under the indication of declining remunerativeness. At the last general meeting the management suggested that the dividend would eventually diminish, and the keen contest in regard to prices which originated directly in connection with the extension of the Bergmann group in the electrical industry will not have improved the possibility of maintaining the high rate of dividend hitherto, which has been 18 per cent. in each of the past six years. Notwithstanding the diminished prospects of remunerativeness, the shares of the Bergmann Co. have recently been to a certain extent included in the upward movement of quotations in the market for electrical securities. It is not improbable that the justification for the present position of quotations is to be found in the endeavours for a further organising improvement in industry, which is also sought for by the Bergmann Co.

At present everything, of course, seems only to be in embryo. The future must show whether the expectations expressed by the quotations of electrical companies are justified by the further development. In any case, the circumstances appear to press towards a further combination of the undertakings. Under circumstances, this could lead to concentration, against which it seems inappropriate and improbable that customers would remain inactive. It has already been shown by the collapsed price protection syndicate that customers are unable to bear without injury and are unwilling to bear too far-reaching arrangements between the large electrical firms, and the future will indicate whether, and if so, how far, the increasing combination in the electrical industry will produce a sufficient counter action on the part of customers.

Since the foregoing was written, an important announcement has been officially made which will bring the Felten & Guilleaume-Lahmeyer Works under the control of the A.E.G., and reduce to three the number of leading competitors in the heavy electrical engineering trade in Germany. The announcement states that when the former was only able to distribute a 6 per cent. dividend for 1909 (as compared with 8 per cent. in 1908 and 10 per cent. in 1907), owing to the former high dividends being prejudiced by the set-back experienced by the company's dynamo works at Frankfort, negotiations were entered upon for the disposal of this particular works. These have now led to an understanding with the A.E.G., whereby the Felten & Guilleaume-Lahmeyer Co. will dispose of the dynamo works to the A.E.G. in return for new shares to be issued by the latter. The works will be transferred to the A.E.G. in the form of a new company, with a share capital of £500,000 and a reserve fund of £150,000. The new company takes over the works and plant, together with inventory and stocks, but exclusive of debtors and creditors. It has, however, only been decided by the A.E.G. to acquire the undertaking on condition that a sufficient number of shares in the F. & G.-L. Co. is simultaneously obtainable on favourable conditions. Large shareholders in the latter have consequently resolved to transfer £800,000 in shares to the A.E.G., so that the latter, in conjunction with the closely-associated Zurich Bank for Electrical Enterprises, will acquire £1,600,000 out of the total capital of £2,750,000 of the F. & G.-L. Co., and thus secure a decided influence in this company, which will no longer continue the name of Lahmeyer in its title. The A.E.G. expects, moreover, advantage from the acquisition of the dynamo works by the removal of a troublesome competitor, and by thus obtaining a base of support in the south of Germany, whilst the intimate connection of its cable works with the Mulheim Carlswerk will also give the company the lead in the department of submarine cables.

The combination thus initiated is also to pave the way for new activity by the F. & G.-L. Co. when free from the dynamo works. The acquisition of the £800,000 in shares is to take place by the exchange of new A.E.G. shares of the nominal value of £500,000;

a second issue of £500,000 is intended as the purchase price of the dynamo works; and a third issue of £500,000 is proposed to be offered to existing shareholders in the A.E.G. at the price of 210 per cent., so as to provide capital for working and developing the dynamo works. The last-mentioned will render over £1,000,000 available for this purpose, whilst the purchase price of £500,000 nominal also represents, on the basis of the present price of the shares, a sum of over £1,000,000. These three capital issues will raise the share capital of the A.E.G. to £6,500,000, and the total capital of shares and bonds or debentures to £9,000,000. An interchange of directors on the boards of the two companies is proposed. It may be expected that the Siemens-Schuckert Works Co., whose dominating sphere of activity in the south of Germany will be threatened by the present scheme, will seek to equalise matters in some way or other, and it would not be surprising if the company arrived at an understanding with the only important outsider now existing, namely, the Bergmann Electricity Works Co., either by absorbing the latter, or by an agreement which would aim at meeting the expansion now resolved upon by the A.E.G.

BREAKDOWNS OF MACHINERY IN 1909.

THE annual report of Mr. Michael Longridge, chief engineer of the British Engine, Boiler and Electrical Insurance Co., Ltd., states that the year 1909 produced little of interest in the way of breakdowns, and the rate of increase in the inspection and insurance of engines fell off from 6 to 3 per cent., a decrease attributed to the bad state of trade. The rate of breakdown was slightly under one in ten of the engines insured. In the case of steam engines, the principal parts which failed were the following :—

	Per cent.
Valves and valve gear	34·1
Air-pump buckets and valves	10·7
Spur gearing	8·7
Columns, bedplates, &c.	5·6
Cylinders, valve-chests and covers	5·6

No other item reached 5 per cent. In the case of gas and oil engines the figures over 5 per cent. were as follows :—

	Per cent.
Valves and valve gear	29·6
Cylinders and cylinder ends	15·4
Main shafts	13·4
Connecting rods and bolts	9·4
Governors and governor gear	5·4
Gas-producer plants	11·4

The causes of the breakdowns are thus classified :—

	Steam, per cent.	Gas and oil, per cent.
Accidents and causes unascertained ...	27	34
Old defects or wear and tear	41	19
Bad design or construction	18	23
Negligence	14	24

Mr. Longridge deduces from this analysis, compared with previous records, that the design and workmanship of British steam engines are improving, and he notes with approval the reduced proportion of accidents due to negligence. As regards gas engines the verdict is not so satisfactory; the weakest part is the crankshaft, and the author questions whether the time has not come to build these up instead of forging them in a single piece.

The examples of steam-engine breakdowns described in detail present no very striking features. The importance of checking the supply of injection water before stopping the engine, when the air-pump is driven by the engine itself, and of stopping the engine before the air pump in the case of an independent condensing plant, is emphasised. The injurious effect of oil upon the foundations of an engine is illustrated, and the author points out that when engines are set on concrete instead of stone, the bed-plates should be carried either on strong cast-iron plates or on machined folding wedges at each holding-down bolt, so that, if the grouting yields, the bed can be made tight with the wedges; tightening the bolts is apt to break the bedplate.

The disastrous effect of sharp angles in keyways is again exemplified. One instance is given of a turbine failure, due to corrosion or accumulation of deposit in the cylinder casing at the high-pressure end, resulting in the breaking-off of 13 rows of blades in the rotor and casing.

The five gas-engine examples all relate to crankshaft failures, mostly in the crank-web, due to the inherent weakness of the material at right-angles to the shaft when forged in one piece. The author suggests that the permissible working stress in these parts should be only half that allowed on necks and crank-pins, or else that the cranks should be built up.

Turning to the inspection and insurance of electrical machinery, while the rate of increase has fallen off in this case also, the increase being 9·8 per cent. as compared with 1908, the breakdowns have decreased 4·1 per cent., and the cost 9·5 per cent. The rate of breakdown was for generators about 1 in 17; motors, D.C. 1 in 8, A.C. 1 in 9¼; starters and controllers, 1 in 25.

The failures are classified as follows :—

	Dynamos, per cent.	Motors, per cent.
Armatures and rotors	40	37
Commutators and slip-rings... ...	29	27
Magnet coils and stators	12	20
Miscellaneous	19	16

In the case of starters and controllers the failures were as follows :—

Resistance coils, per cent...	52
Contacts and switch arms, per cent.	9
Automatic apparatus, per cent.	21
Parts not carrying current, per cent.	18

No fewer than 85 per cent. of the electrical machines insured are motors, and a comparison between D.C. and A.C. motor failures may be of interest :—

	D.C., per cent.	A.C., per cent.
Armatures or rotors	39	23
Commutators or slip-rings...	31	6
Magnet or stator coils	15	49
Brush gear and terminals	3	8
Parts not carrying current	12	14

The causes of the breakdowns are thus analysed :—

	Dynamos.	Motors.	Controllers.
Accidental, per cent.	5	2	5
Dirt and neglect	20	26	19
Age and deterioration	16	14	17
Bad work or design	23	14	14
Overloading	1	1	2
Unascertained	35	43	43

One of the breakdowns, in a 500-volt dynamo, was due to an iron ferrule which must have been dropped into the armature before the commutator connections were all soldered up. Yet the machine had run for about two years before the inevitable short-circuit took place. The oil in a mining motor controller box took fire, and ignited the cables leading from it; the author points out the uselessness of the sand provided under the Special Rules for the extinction of fires, in the case of these vertical cables, and suggests that chemical extinguishers might be more effective. A very troublesome breakdown took place in connection with an induction motor, which sometimes started all right and sometimes stuck; it was eventually found that the upper halves of the bushes were worn and allowed the rotor to come into contact with the stator under the pressure of the gearing. This leads Mr. Longridge to the suggestion that the shields over the end windings of such machines should be so arranged that the width of the clearance between the rotor and stator can be inspected without dismantling the machine. A bad case of formation of nitrous compounds in the stator coils of a large induction motor running on 11,000 volts is described. The fact that high-pressure conductors, whether forming parts of machines or in cables, when well-insulated and of large capacity may remain charged for a considerable time is pointed out, and the necessity of caution in handling such is very properly emphasised.

Dealing with boilers, the chief engineer considers the increase of 4¾ per cent. in the number under inspection "very satisfactory, having regard to the rate at which small steam engines are being supplanted by gas engines and electric motors." During 1909 there were only three explosions of land boilers, without fatal results.

Several tests carried out by the company are included in the report. One deals with the measurement of the discharge of a turbo-blower with the aid of the Pitot tube; another is a test of a 500-KW. exhaust steam turbo-generator, with a turbine of the impulse type, fed for the purpose of the test with steam from boilers, through a reducing valve. The steam was therefore superheated about 78° F., making the consumption lower than it would have been with exhaust steam. The trial lasted seven hours, and the steam per KW.-hour at full load was found to be 40 lb. Trials were carried out on a horizontal compound tandem engine of 1,250 I.H.P., made in Belgium and erected near Manchester; the steam consumption at full load was 10·75 lb. per I.H.P. per hour, the steam being supplied at 146·5 lb. per sq. in., superheated 171° F. The equivalent consumption of saturated steam was 11·72 lb., and the thermodynamic efficiency of the engine was 0·59.

Another test was carried out, on a boiler designed by Prof. Nicolson, to demonstrate the effects of counter currents and high velocities of gas and water over heating surfaces, and to prove that the heat transmitted through a boiler plate is proportional to the product of the density and velocity of the gas current. The details of this interesting trial are given in full. A Cornish boiler was used, specially constructed for the purpose of the tests; the flue beyond the bridge was lined with firebrick for a distance of 5 ft. 4 in. to form a combustion chamber, spanned by a firebrick arch to break up the gas current; beyond this chamber a plug of firebrick was inserted, reducing the area of the flue to an annular passage about 2 in. wide and 10 ft. long, the diameter of the plug being 3 ft. 1 in., to force the gases to travel at a high velocity in close contact with the plates. After leaving the internal flue the gases passed through an "evaporator" containing 102 small water-tubes, and an "economiser" containing 90 small water-tubes. Induced draught was provided by a fan beyond the economiser. The total heating surface was 656 sq. ft., and the grate area 18·1 sq. ft. Forced circulation of the water in the evaporator tubes was provided, and the steam for the fan and pump amounted to from 10·8 to 14·6 per cent. of the total output—mainly for driving the fan. Evaporations (from and at 212°) up to 23 lb. per hour per sq. ft. of heating surface were recorded, and the thermal efficiency was from 73·8 to 79·1 per cent., the net efficiency, after allowing for the fan and pump consumption, being from 64·4 to 69·1 per cent.

The temperature attained in the combustion chamber exceeded 2,000° F. The mean velocity of the gases in the contracted part of the flue was from 64 to 110 ft. per second, and upwards of 32,000

B.TH.U. was transmitted through the "plug flue" per sq. ft. per hour—the rate of transmission probably exceeding 40,000 B.TH.U. The draught pressure near the fan was generally about 18 in. or 19 in. of water.

The equivalent evaporation per lb. of dried fuel (from and at 212°) was between 10 and 12 lb. of water, and the total evaporation per hour ranged up to 7,040 lb.

The author states that having in view the high rates of combustion and evaporation, the thermal efficiencies obtained are exceptionally good, and the results recorded should be useful to designers.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

RUSSIA (*continued from page* 399):—

Rouble = 2s. 1½d.; poud = 36 lb.

	Roubles per poud.
Machines and apparatus, complete or incomplete, fitted together or in parts:	
Of cast or wrought-iron or of steel, with or without copper to an extent not exceeding 25 per cent. of the total weight of the machine:	
All kinds not separately designated	2·10
Gas and petrol motors, steam engines and electric locomotives, compressors and ice-making and refrigerating machines, also spare parts imported together with the machines	3·20
All kinds of machines and parts imported separately made of copper or its alloys, or in the composition of which copper, or any alloy of copper, is present in a proportion exceeding 25 per cent. of the total weight of the machine	8
Dynamo-electric machines and electro-motors of all kinds	8·50
Transformers	8·50
Parts of dynamo-electric machines and transformers:	
Coils	17·70
Armatures and collectors	12·75
Beds with parts (besides the plugs) of copper ...	8·50
Other parts:	
Containing more than 25 per cent. of copper ...	8
Of iron or steel, and not containing more than 25 per cent. of copper	4·20
Electro-technical measuring appliances (ammeters, wattmeters, voltmeters and calculators) and parts thereof	12
Optical, physical, chemical, mathematical appliances and apparatus, instruments, &c., for medical purposes, manometers, vacuometers, indicators and calculators (other than those mentioned above), electrical switches and cut-outs, caps for electrical incandescent lamps, rheostats and commutators of all kinds fitted together or in parts; telegraphic and telephonic apparatus; electrical and pneumatic bells, and accessories for electrical signalling, and separate parts of all these	9
Electrical incandescent lamps, mounted	30
Ditto, without mounting...	60
Spare parts of electric bells, batteries, and other appliances which wear out by use and require to be replaced by new ones, such as zinc, copper and other plates for cells, carbons for the same, and for lamps, lanterns, &c.	Dutiable according to the material of which composed.
Railway and tramway cars, other than horse:	
Goods wagons, per axle	360
Carriages, 1st and 2nd class (composite), per axle ...	615
" 2nd and 3rd class " "	495
" 1st class, per axle	697·50
" 2nd class, per axle	532·50
" 3rd class, luggage and mail vans, per axle	450

NEW PATENTS APPLIED FOR, 1910.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

20,089. "Improvements in and relating to switches and like apparatus." SIEMENS BROS. DYNAMO WORKS, LTD., and C. E. SHANN. August 29th. (Complete.)

20,095. "Improvements in and relating to electrically-operated playing apparatus for musical instruments." D. M. CLARK. (Teleelectric Co., United States.) August 29th. (Complete.)

20,107. "Improvements in current collectors or contact columns for electric cranes and the like." A. WEST & Co., LTD., and W. J. MOGGRIDGE. August 29th.

20,111. "Perforator and transmitter for printing telegraphs." J. CARPENTIER. (Date applied for under Sec. 91 of the Act, November 5th, 1909, being date of application in France.) August 29th. (Complete.)

20,118. "Improvements in and relating to the control of electrically-operated lifts, elevators and the like." H. C. WALKER and R. WAYGOOD AND Co., LTD. August 29th.

20,138. "Cutting tool permitting of removing without heating the swellings formed on the links of electrically-welded chains." C. PREUD'HOMME. August 29th. (Complete.)

20,156. "Improvements in ceiling roses for electric light pendant fittings and the like." L. M. WATERHOUSE. August 30th.

20,180. "Improvements in and relating to anodes for electrolytic purposes." H. E. BEACH. August 30th.

20,248. "Improvements in cableways for dumping mounds." W. WEIHE. (Date applied for under Sec. 91 of the Act, August 31st, 1909, being date of application in Germany.) August 30th. (Complete.)

20,249. "Improvements in and relating to electrically-driven ring-spinning machines." A. C. EBORALL and BROWN, BOVERI & Co., LTD. August 30th. (Complete.)

20,257. "Improvements in automatic electric switches." H. LEITNER. August 30th.

20,326. "Electric circuits for railway signals." SIEMENS BROS. & Co., LTD. (Siemens & Halske Akt.-Ges., Germany.) August 31st. (Complete.)

20,374. "Improvements in permanent magnets." G. HOOKHAM. September 1st.

20,391. "Improvements in sealing wires and the like." V. M. HUTTON. September 1st.

20,399. "Improvements relating to sound magnifying devices for telephones also applicable for use with talking machines." A. E. LAMKIN and P. C. PACE. September 1st. (Complete.)

20,404. "Improvements in or relating to electrical furnaces." M. RUTHENBURG. September 1st. (Complete.)

20,410. "Improvements in and relating to electric sparking plugs for internal-combustion engines." T. H. WILLIAMS. September 1st.

20,433. "Improvements in and relating to electromagnetic couplings for shafts." G. W. MONEY. September 1st.

20,441. "Improvements in receiving apparatus for wireless telegraphy." MARCONI'S WIRELESS TELEGRAPH Co., LTD., and H. J. ROUND. September 1st. (Complete.)

20,443. "Automatic rheostat for mechanically cutting out and reinserting resistance of electric motors." M. T. MEDWAY. September 1st.

20,444. "Combined electrical and mechanical lift gate or door, lock and catch." M. T. MEDWAY. September 1st.

20,447. "Improvements in and connected with electric heaters." SPAGNOLETTI, LTD., and H. H. HOLMES. September 1st.

20,455. "Improvement relating to electric motor for blowing organs and harmoniums." H. W. LAXTON. September 2nd.

20,460. "Improvements in automatic electric switching apparatus." A. J. HOWARD and A. C. ALLEN. September 2nd.

20,478. "Improvements in or relating to memorandum and like appliances for use in connection with telephones and other purposes." E. F. M. BRANSON. September 2nd.

20,526. "Electrically-actuated typewriter with type-wheel and keys." O. FISCHER. September 2nd. (Complete.)

20,546. "Improvements in and connected with boxes for carrying incandescent gas mantles and electric globes." A. A. BROWN. September 3rd.

20,585. "Improvements in or connected with devices for making and breaking electric contacts." F. H. VARLEY. September 3rd.

20,594. "Improvements in the production of steel by electrical method." T. LEVOZ. (Date applied for under Sec. 91 of the Act, September 4th, 1909, being date of application in Belgium.) September 3rd. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1909.

METAL MOULDING FOR ENCASING ELECTRIC WIRES AND APPLICABLE FOR SUPPORTING PICTURES. P. T. Kenny. 17,999. August 4th.

ELECTRIC ADVERTISING SIGNS. H. A. Clements. 18,310. August 9th.

ELECTRODES FOR ARC LAMPS. F. M. Lewis. 18,469. August 10th.

RECEIVING APPARATUS FOR WIRELESS TELEGRAPHY. G. Marconi and Marconi's Wireless Telegraph Co. 18,922. August 17th.

RECORDING AND INDICATING OF THE WORKING OF HYDRAULIC AND ELECTRIC LIFTS OR HOISTS. H. A. Matear, T. F. Kenney and H. Woodhouse. 19,203. August 20th.

ELECTRIC INDUCTION FURNACES. R. Evans-Jackson. (A. Hiorth.) 24,302. October 12th.

AUTOMATIC TELEPHONE EXCHANGES. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 27,458. November 25th.

METHOD OF CHARGING ELECTRIC RESISTANCE FURNACES. A. Petersson. 27,674. November 27th. (Date applied for under International Convention, January 7th, 1909.)

WORKING OF SINGLE-PHASE COMMUTATOR DYNAMO-ELECTRIC MACHINES. Siemens Bros. Dynamo Works. (Siemens Schuckertwerke Ges.) 29,030. December 13th.

PREPAYMENT APPARATUS FOR THE SUPPLY OF GAS, ELECTRICITY, OR THE LIKE. J. Hansford and J. F. Wright. 10,934. May 8th.

1910.

ELECTRICALLY OPERATED INDICATING, REGISTERING AND CONTROLLING DEVICES. Soc. d'Electricité "Nilmelior" and J. E. Colas. 827. January 12th. (Date applied for under International Convention, January 13th, 1909.)

APPARATUS FOR PURIFYING LIQUIDS BY ELECTRICITY. H. B. Hartman. 1,461 and 1,462. January 19th.

TELEGRAPHIC RELAYS. I. Kitsee. 2,849. January 31st.

ELECTRIC FIRE AND BURGLARY ALARM CONTACT. J. Phillips-Woodey. 5,510. March 5th. (Cognate application, No. 8,573 of 1910.)

SUSPENSION OF ELECTRIC TROLLEY WIRES. M. Jellinek and J. F. de Tovaros. 8,831. April 12th. ((Date applied for under International Convention, July 19th, 1909.)

PREPARATION TO BE EMPLOYED IN MAKING ELECTROLYTE FOR PRIMARY BATTERIES. B. E. R. Newlands and R. M. Parkinson. 9,176. April 15th. (Application for Patent of Addition to No. 11,926 of 1909.)

ELECTRIC CIRCUIT BREAKER. Adams Manufacturing Co. (Cutler-Hammer Manufacturing Co.) 10,771. May 2nd.

MANUFACTURE OF AN IMPROVED BENT LEVER FOR INTERRUPTERS, SUCH AS ARE USED IN CONNECTION WITH IGNITION DEVICES IN INTERNAL-COMBUSTION ENGINES. Firm of Robert Bosch. 13,589. June 4th. (Date applied for under International Convention, February 4th, 1910.)